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SERVICE MANUAL No. I-0006

ROTARY GAS / HYDRAULIC OPERATOR

CUSTOMER:____________________

P.O.#:____________________

W.O.#:____________________

TAG:____________________

DATE:____________________

APPLIES TO OPERATOR MODEL:____________________

SECTION I GAS / HYDRAULIC ROTARY VALVE OPERATOR

. . . continued

SECTION I GAS / HYDRAULIC ROTARY VALVE OPERATOR

I SAFETY WARNINGS

1. OPERATING INSTRUCTIONS (Page 6)

   This equipment exhausts gas as part of its operating cycle. Wear hand, ear, and eye protection, and keep sparking devices and open flames away.

2. INSTALLATION (Page 8)

   For final assembly over stem to valve lifting eyes are to be used in combination, with a 3 leg sling with one shortening hook, to lift the operator only.

3. INSTALLATION (Page 8)

   Excess operator travel can cause damage to end of stroke (trigger) valve if over-travel occurs and the trigger interferes with the component. The operators mechanical end-stops are preset at the factory for 90° travel.

4. START-UP CHECKS (Page 12)

   If unit has a fail or ESD (Emergency Shut Down) position, the failsafe or ESD controls may have to be temporarily disabled, bypassed or overridden by AUTO / MANUAL selector to prevent inadvertent valve operation.

5. MAINTENANCE AND OPERATIONAL TESTING (Page 14)

   DE-PRESSURIZE operator before attempting to service power gas filter, check tank fluid level or check manual operation of handpump.

6. END OF STROKE VALVE INSTRUCTIONS (Page 16)

   Changing operator travel can cause damage to end of stroke (trigger) valve if over travel occurs and trigger strikes component.

7. OPERATOR MAINTENANCE (Page 18)

   Gas / Hydraulic tanks should be drained and flushed if fluid is contaminated with scale, rust, particulates, water, foam, or etc. Flush only with hydraulic fluid. Refill with filtered fluid.

Please refer to the applicable section for details and further information.

OPERATING PROCEDURE

1. MANUAL OPERATION WITH POWER GAS

A) PRESS UPPER LEFT RELAY HANDLE AND HOLD TO CLOSE LINE VALVE.

B) PRESS UPPER RIGHT RELAY HANDLE AND HOLD TO OPEN LINE VALVE.

2. MANUAL OPERATION WITHOUT POWER GAS

A) TURN LOWER LEFT VALVE HANDLE AND OPERATE HAND PUMP TO CLOSE LINE VALVE.

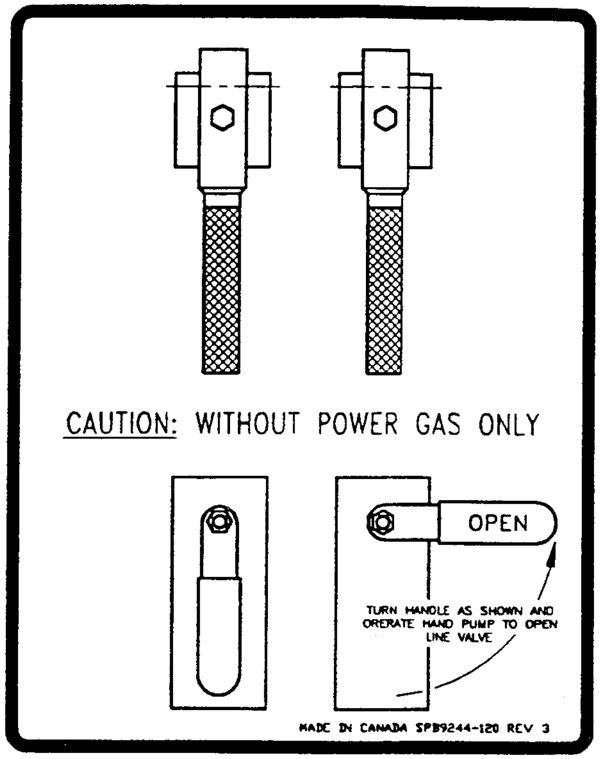
B) TURN LOWER RIGHT VALVE HANDLE AND OPERATE HAND PUMP TO OPEN LINE VALVE.

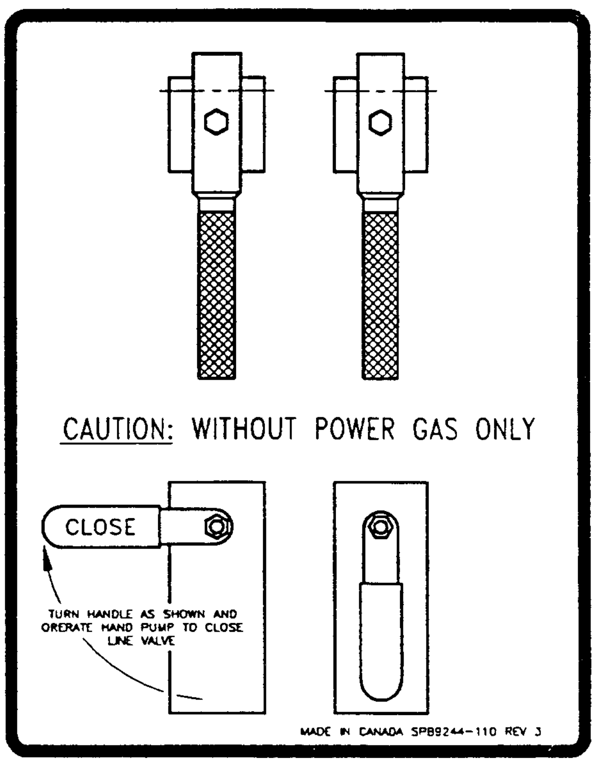
3. TO DISARM OPERATOR

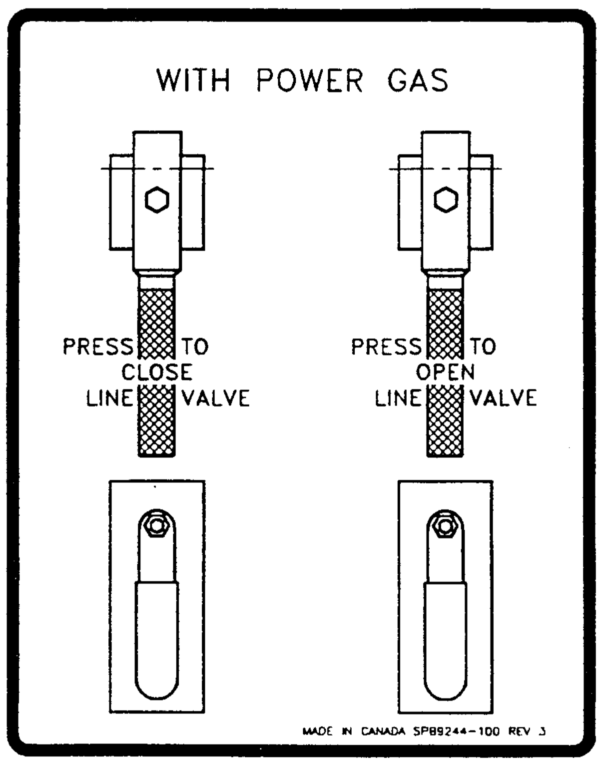
A) SHUT OFF POWER GAS SUPPLY.

B) PUSH EITHER UPPER RELAY HANDLE HALFWAY TO BLEED PRESSURE.

SPB9244-130 REV -







II OPERATING INSTRUCTIONS

Refer to specific schematic drawing and list of components at the end of this document and "Operating Procedure" diagram which is located inside the control package cover on the unit, also reproduced on pages 5 through 9.

NOTE: Operating procedures for equipment with automatic switching capability vary with particular applications. Refer to Owner's Procedures for operators with automatic or remote switching devices.

NOTE: The four valves needed for local manual operation are located on a manifold plate inside the control package compartment. The handpump is located below the control package compartment.

CAUTION: This equipment exhausts gas as part of its operating cycle. Wear hand, ear and eye protection, and keep sparking devices and open flames away.

A. WITH POWER GAS or auxiliary nitrogen bottle present, appropriate supply shutoff valves open, and both handles of lower hydraulic handpump switching valves in vertical position against stops:

1. To close the line valve, press and hold handle on upper left gas switching relay. Release after line valve is closed.

2. To open the line valve, press and hold handle on upper right gas switching relay. Release after line valve is open.

B. WITHOUT POWER GAS, and supply shutoff valve closed:

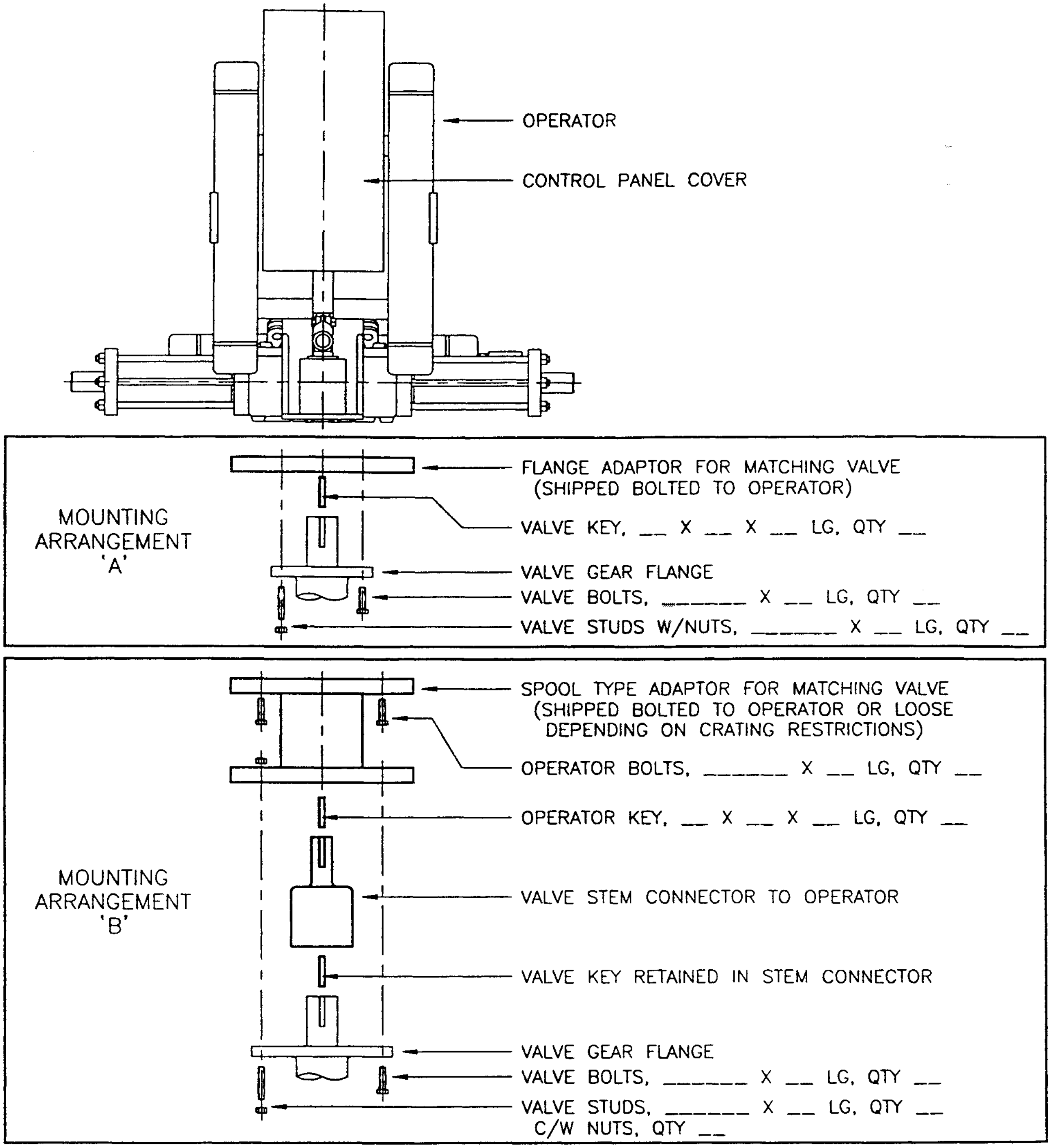
1. To close the line valve, rotate the handle on lower left hydraulic switching valve clockwise against stop. Operate handpump to close valve. Return valve handle to vertical position against stop when line valve is closed.

2. To open line valve, rotate the handle on lower right hydraulic switching valve counter clockwise against stop. Operate handpump to open line valve. Return valve handle to vertical position against stop when line valve is open.

Placing hydraulic switching valve in mid position at the completion of handpump operation will allow the handpump plunger to be returned to retracted position. Do so, and then return hydraulic switching valve handle to vertical position.

C. TO DISARM OPERATOR, shut off supply valve and press handle on either upper gas switching relay halfway to vent power gas:

NOTE: Read this document through to understand the general arrangement and functioning, and be able to proceed safely and efficiently. Have the necessary tools and equipment at hand.



NOTE: OPERATOR SHIPPED IN THE CCW POSITION. MOUNTING HARDWARE LOCATED IN BOX ON PALLET OR INSIDE CONTROL PANEL COVER

UNLESS SPECIFIED OTHERWISE
ALL DIMENSIONS INCHES [mm]

UPDT LOGO
2 AS-1998-04-27 @ 6053-1-B
UPDT TITLE BLOCK
1 RS-1996-09-11 @ SALES
REV BY-DATE+REF

TOLERANCES
XXX ±0.5 [±10]
XX ±0.2 [±5]
X ±0.1 [±2]

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BETTIS CANADA LTD.

ROTARY GAS/HYDRAULIC OPERATORS
MOUNTING INSTRUCTIONS
FOR VALVES WITH GEAR FLANGES

I-0097--.DWG_VIEW_00
APR-27-98

SCALE N/A	BY KN	CHK	DATE APR-26-93
W.O. ---		DWG. NO. I-0097	REV 2-

III INSTALLATION

NOTE: Mounting hardware is usually in a separate box on shipping pallet / crate or inside panel cover of unit. Gas / Hydraulic tanks must remain generally vertical, regardless of valve and valve stem orientation. **Lifting eyes are to be used in combination, with a 3 leg sling with one shortening hook, to lift the operator only.**

A. FIELD MOUNTING

1. If valve is installed in line, fully open or closed position can be determined only with reference to valve stem key and run of valve, or valve stops. Refer also to valve manufacturer's instructions. But in general:

   a) The operator internal stops, not the line valve's, must govern travel.

   b) Valve manufacturer and buried extension manufacturer must provide a precise mechanical stem stop or indicator marks calibrated before valve installation. For example, ±1° valve closure position translates to only ±0.035" [0.89 mm] at periphery of 4" [100 mm] diameter stem.

   c) For block and bleed type ball valves only, if the indicator marks are lost or covered, the closed and / or open position may be found by trial and error body blowdowns. This is a task for a millwright and a valve technician, and requires special equipment. Different types of valves have other ways for checking these positions, so check with valve manufacturer's instructions, if at all possible.

   d) For most valves, if the valve stop is wrong or the indicator marks are lost or obscured, the closed position may be assumed 90° ±1°, from full open.

   e) For central stem lubrication valve refer to drawing C-0180 on page 9.

2. Place operator and valve in the same position (both open or both closed). Damage to valve and / or operator can be caused if operator tries to open or close a valve against valve internal stops. Operator position can be controlled and confirmed safely by operation with handpump.

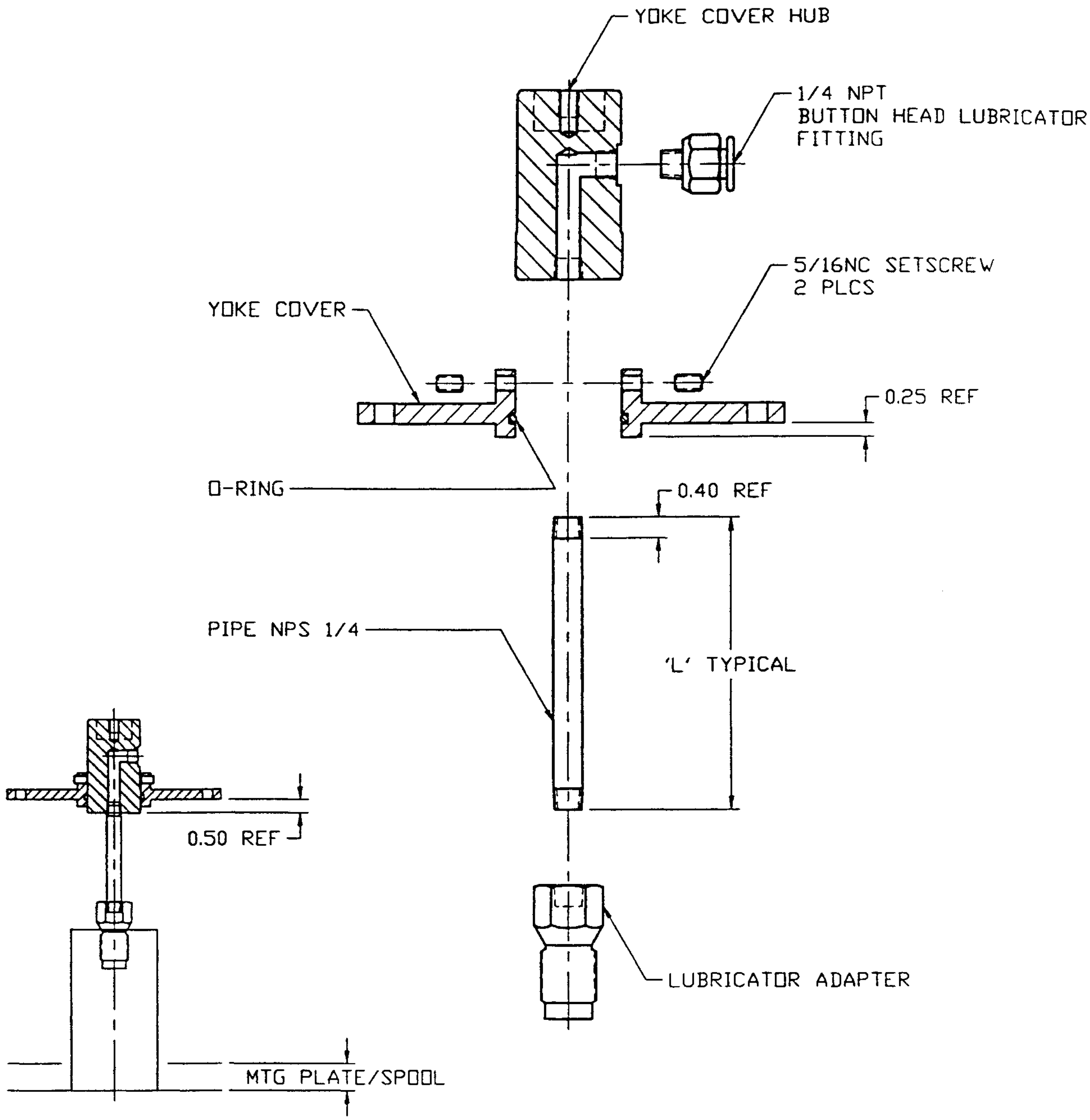
3. Check mounting surfaces, valve stem, operator bore and orientation for any dimensional discrepancy, dirt, rust, etc.

4. If access to yoke cover is obstructed by limit switch or other accessories, it is recommended that the stem key be set in place at this point (before actuator is installed on the valve stem). If so, double check item 1 above, be sure that tapped hole in key is to top of valve stem, and ignore item 7 below.

5. Set operator in position on the valve. Keep hooks and chains clear of tubing and accessories.

6. Install mounting bolts to fasten operator to valve. Align operator to valve while bolts are slightly loose, then tighten mounting bolts evenly and thoroughly to industry standard for the grade and size of bolt.

7. If necessary, temporarily remove yoke cover and install key with tapped hole for eyebolt to top of valve stem.



UNLESS SPECIFIED OTHERWISE
ALL DIMENSIONS INCHES [mm]

BETTIS Actuators & Controls
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BETTIS CANADA LTD.

TYPICAL LUBRICATOR EXTENSION
TO LUBRICATOR PLUG VALVE
w/ ROTARY LIMIT SWITCH

UPDT LOGO
3 AS-1998-04-27 @ 6053-1-B
REDRAW CAD
2 PO-1998-01-02 @ 6053-1-B
REV BY-DATE+REF

C-0180--.DWG_VIEW_00
APR-27-98

SCALE 1:3	BY MN	CHK [illegible]	DATE DEC-23-91
W.O. ---	DWG. NO. C-0180		REV 3-

8. If necessary, adjust operator end stops for line valve fully open and fully closed positions. (Stops are factory adjusted for approximately 90° rotation.) Refer to Operator Cutaway drawing on page 22.

    a) Rotate operator against its stop to be adjusted.

    b) Remove stop cover. It should be tight and may require torque wrench; call for assistance or proper tools rather than improvise.

    c) Adjust end-stop into or away from operator as required. To adjust the end-stop into the operator, first use the handpump to position the operator. (Estimate based on thread pitch if adjustment is away.)

    d) Rotate operator against stop if adjustment (c) was away.

    e) Install and tighten stop cover against o-ring.

Notice the end stop adjustment table below. The stop cover must be tightened firmly to seal against full rated pressure.

NOTE: Excess operator travel adjustment can cause damage to end of stroke (trigger) valve if over-travel occurs and trigger interferes with the component. Refer to limit switch layout on page 17.

END STOP MOVEMENT VS. DEGREES ROTATION

	Series 7	Series 6	Series 5	Series 3	Series 2
End Stop Movement per turn (inches)	.125	.125	.125	.125	.091
Stem / Shaft Rotation per turn (degrees)	1.02	1.30	1.43	2.05	1.65
End Stop Location	cylinder	cylinder	cylinder	cylinder	drive case
Cover or Jam Nut Torque (ft-lb)	360	130	90	45	40

9. Replace yoke cover and gasket, proceed to "Install Connections" and "Prestart-up Checks".

IV INSTALL CONNECTIONS

1. Supply gas take-off should be from top or side of header. Supply gas connection is as per schematic drawing. User should provide a shutoff valve on supply, and size lines to ensure draw down when operating valve does not interfere with pressure sensing devices, that is, use proper size of tubing for flow and pressure purposes.

2. In the case of a volume tank (power gas storage bottle) with inlet check, user should confirm that the tank is rated and / or protected against any possible supply overpressure or thermal expansion overpressure.

3. Electrical connection(s), to junction box if any, are as per wiring diagram and electrical drawings.

4. Conduit connection to limit or pressure switch, if field installed, are to comply with all local regulations (seal within 18 inches for explosion proof).

V PRESTART-UP CHECKS

A. CHECK OPERATOR

1. Unit has been mounted on valve properly. Gear flange mounting bolts, stem key, setscrew(s) installed and secured.

2. No tubing damaged or accessories dislodged during shipping or installation.

3. Indicated position confirms valve position.

4. All switching valves in normal operating position as per DIAGRAM / INSTRUCTIONS.

5. If removed, yoke cover bolts, limit switch / end of stroke mounting bolts have been replaced and secured.

6. Limit switch / end of stroke valve trigger(s), if removed for valve installation, have been replaced and are properly set. Refer to "Instructions to Set Limit Switches..." on page 15 for applicable instructions.

7. Switchpak shaft centerline aligned with yoke cover / operator stem centerline. Refer to drawing IB0048-08 on page 43.

8. In case of valve stem lubricator, two piece yoke cover setscrews are secured and stem section is centered in yoke cover. There is a gap between top of stem and switchpak adapter. Refer to drawing C-0180 on page 9.

B. CHECK CONNECTIONS

1. Pneumatic / hydraulic components connected as per schematic enclosed or in service manual supplied.

2. Power gas / signal gas connected to identified ports.

3. Electrical connections in junction box terminals are secure.

4. Wiring as per enclosed diagram or service manual supplied.

5. SWITCHPAK . . . remove cover . . .

   a) ensure wiring will not become tangled or hooked by nylon trigger screws during rotation.

   b) nylon trigger screws are in correct location between switch stacks, if ALLEN adjusting screws are accessible when valve / operator is in either open or closed position.

NOTE: 'ZSO_' actuated at fully open position.
'ZSC_' actuated at fully closed position.
LOWEST 'ZS__' IN STACK IS ZSOA; the one next to operator.

VI START-UP CHECKS

NOTE: If unit has a fail or ESD (Emergency Shut Down) position, the failsafe or ESD controls may have to be temporarily disabled, bypassed or overridden by AUTO / MANUAL selector to avoid inadvertent valve operation.

To check operation in AUTO or MANUAL mode, temporarily disconnect the ESD control component (pilot, solenoid, switching relay) signal line, and plug or cap it so it does not bleed the system during check out procedures.

1. If possible, manually operate unit to full open and close positions by a handpump on unit, or low pressure (100 psi) power gas applied to supply port. When each position has been reached, CHECK:

   a) Operator stop settings. If adjustment is required refer to installation on page 8.

   b) Fluid levels in tanks. Refer to tank filling drawing I-0006-13 on page 24 and the decal on the manifold plate for correct level for each position.

   c) Limit switch / end of stroke actuated at or before respective correct position.

2. Power gas supply. CONFIRM power gas supply PRESSURE.

   a) Gas / Hydraulic rotary or linear maximum operating pressure as per tank and operator Name Plates, minimum as specified by user's Engineer.

3. Leak test by applying power gas supply and at end of stroke manually maintain power gas on system for TWO MINUTES. CHECK:

    a) for leaks at supply points / fittings in supply line.

    b) for hydraulic / air leaks at fittings while operator is operating.

4. To check manual and automatic operation:

    a) if unit has auto / manual selector place selector in "MANUAL" position

    b) open power gas supply valve or apply power gas to unit

    c) Manually operate upper relays as per instructions to stroke unit to "open" and / or "close" position. Check for leaks at connections and exhaust gas / blowby after stroke is completed. There will be exhaust during travel of the operator.

    d) Put selector in "AUTO" position.

    e) Simulate automatic operation by energizing or de-energizing solenoid(s), and / or switching relays.

    f) Check for leaks / blowby at exhaust port of components during operation, limit switch actuation and end of stroke venting.

    g) Put operator in normal operating position for ESD / Fail operation check out which follows below.

5. SHUT OFF POWER GAS SUPPLY, DISARM OPERATOR AS PER INSTRUCTIONS.

    a) Replace any tubing that was removed, or disconnect any that bypassed ESD COMPONENT for above test.
    b) Remove electrical jumper(s) installed to simulate "AUTO" operation unless required to operate ESD device.

6. EMERGENCY SHUTDOWN / FAIL POSITION OPERATION CHECK OUT

    a) Ensure operator is in normal operating position.

    b) Apply / remove the required ESD signal to operate the unit.

    c) Apply power gas supply to the unit, it should operate to ESD / Fail position.

NOTE: If unit has power gas storage bottle on it, you may want to install a gauge in high pressure (inlet) gauge port of regulator and check the consumption and number of strokes available.

7. RESTORE ALL TUBING AND WIRING AS PER FACTORY SHIPPED OR NORMAL OPERATING CONDITIONS.

VII SCHEDULED MAINTENANCE AND OPERATIONAL TESTING

A program of scheduled maintenance and operational testing of the operator by a trained technician is recommended.

NOTE: DE-PRESSURIZE operator before attempting to service power gas filter, check tank fluid level or check manual operation of handpump.

The following test and maintenance procedure should be performed **AT LEAST ONCE PER YEAR.**

1. Drain accumulated moisture and contaminants from gas filter. Refer to "General Service Notes" on page 29.

2. If step (1) indicates heavy accumulations, drain contaminants from GAS / HYDRAULIC TANK(S) and check tank levels. Refer to "General Service Notes" on page 29.

   NOTE: Consider replacing filter element(s) as it may be clogged with contaminants.

3. If line valve position must not be changed, remove valve stem key if necessary to disconnect operator from valve before proceeding or proceed to verify system for given line valve position; only to do opposite side at later date.

   NOTE: With gate valve operator, decoupling is not recommended, also shut speed controls off if provided, to prevent line valve movement.

4. Refer to "Operating Instructions" on page 6 to ensure that proper method of operation is followed.

5. Check manual operation with handpump (if applicable).

   a) There should be noticeable suction on the suction stroke, decreasing as the pump cylinder fills, indicating suction lines are open and full of fluid.

   b) Handle effort on the pressure stroke will depend on line pressure and line valve position.

   c) Pressure stroke should be smooth and feel solid, not spongy, indicating pressure lines are open and full of fluid.

   d) At the end of operator stroke (line valve open or closed) the handle should stop solid on the pressure stroke, indicating no bypass flow in operator or hydraulic components.

   e) Test by applying 150 lb force for two minutes to the pump handle provided with the unit.

6. Check manual operation with power gas (if applicable).

   a) Depress appropriate relay handle. There should be a momentary flow of gas from exhaust port in intermediate position.

      NOTE: Some effort (up to 50 lbs) should be required to fully depress handle, indicating adequate supply pressure.

   b) The operator should stroke smoothly, indicating Gas / Hydraulic tank levels are okay and operator mechanicals are okay.

c) Fluid returning to the opposite tank during stroking will cause a continuous slight exhaust gas flow from exhaust port, but which stops when the operator reaches end of stroke. This indicates proper relay function and no bypass flow in operator or Gas / Hydraulic components.

d) There should be no leaks of gas or hydraulic fluid.

e) Upon releasing relay handle, there should be a momentary rush of gas from exhaust port as the pressurized Gas / Hydraulic tank is vented.

7. Operating with power gas, check remote / automatic operation (if applicable).

NOTE: Ensure that adequate pressure and flow of gas, and correct hydraulic fluid levels are present.

a) Shutoff valve should be open.

b) There should be no gas leaks.

c) Hydraulic speed control valves should be partially open..

d) With appropriate meter or gauge, check for correct signal condition.

e) Simulate remote or automatic switching.

f) During stroking of the operator, there should be no signal gas leakage indicating that the signal section of the switching relay is okay.

g) Test the handpump safety feature. With the handpump handle in place and the handpump in manual mode, while standing <u>well clear</u>, apply power gas manually in the same direction (open / close) as handpump selected and observe for any handpump handle movement.

VIII INSTRUCTIONS TO SET LIMIT SWITCH

NOTE: Operator stops must be set for valve travel before attempting adjustments. Determine operator / valve position (ie. open / closed, fail position) before making adjustments.

Refer to drawing IB0048-08 on page 43. SW Switchpaks are supplied with up to 8 micro-switches. For example, the SW14XX has four micro-switches and the SW28XX has eight micro-switches.

A. INSTALLATION

1. Remove cover (3).

2. Attach housing (1) to stationary bracket with cam shaft and rotary stem (adapter) engaged.

3. Before tightening mounting screws check that the Switchpak cam shaft is concentric to

stem.

4. Tighten stem (adapter) set screw, checking that the setscrew is tightened against the flat section of the cam shaft.

B. ADJUSTMENTS

NOTE: Setpoints are factory set per wiring diagram if applicable.
Limit switches are staggered with spacers in two stacks:
The lowest on the stack is 'ZSOA'.
'ZSO_' actuated at fully open position.
'ZSC_' actuated at fully closed position.

1. To adjust, loosen cam set screw (19) rotate cam to position desired and re-tighten set screw.

   NOTE: The correct location of the cam is based on the trigger screw being advanced from between 1/32 to 3/32 inches from the micro-switch trip position, as required to suit the application.

2. Sensitivity is factory set. To adjust, turn trigger screw (20) out to advance and lengthen signal, turn in to shorten and delay.

IX INSTRUCTIONS TO SET END OF STROKE

Refer to drawing I-0046 on page 17.

NOTE: Operator stops must be set for valve travel before attempting adjustments. Determine operator / valve position (ie. open / closed, fail position) before making adjustments.

CAUTION: Changing operator travel can cause damage to end of stroke (trigger) valve if over travel occurs and trigger strikes component.

The "End of Stroke" (Trigger Valve) ensures that Gas / Hydraulic tanks and cylinders are depressurized at the end of each automatic operation as specified by many users.

1. If yoke cover with trigger and limit switch assembly was removed for installation of stem key, then leave it off.

2. Stroke operator to the fail position.

3. Install yoke cover, and limit switch assembly.

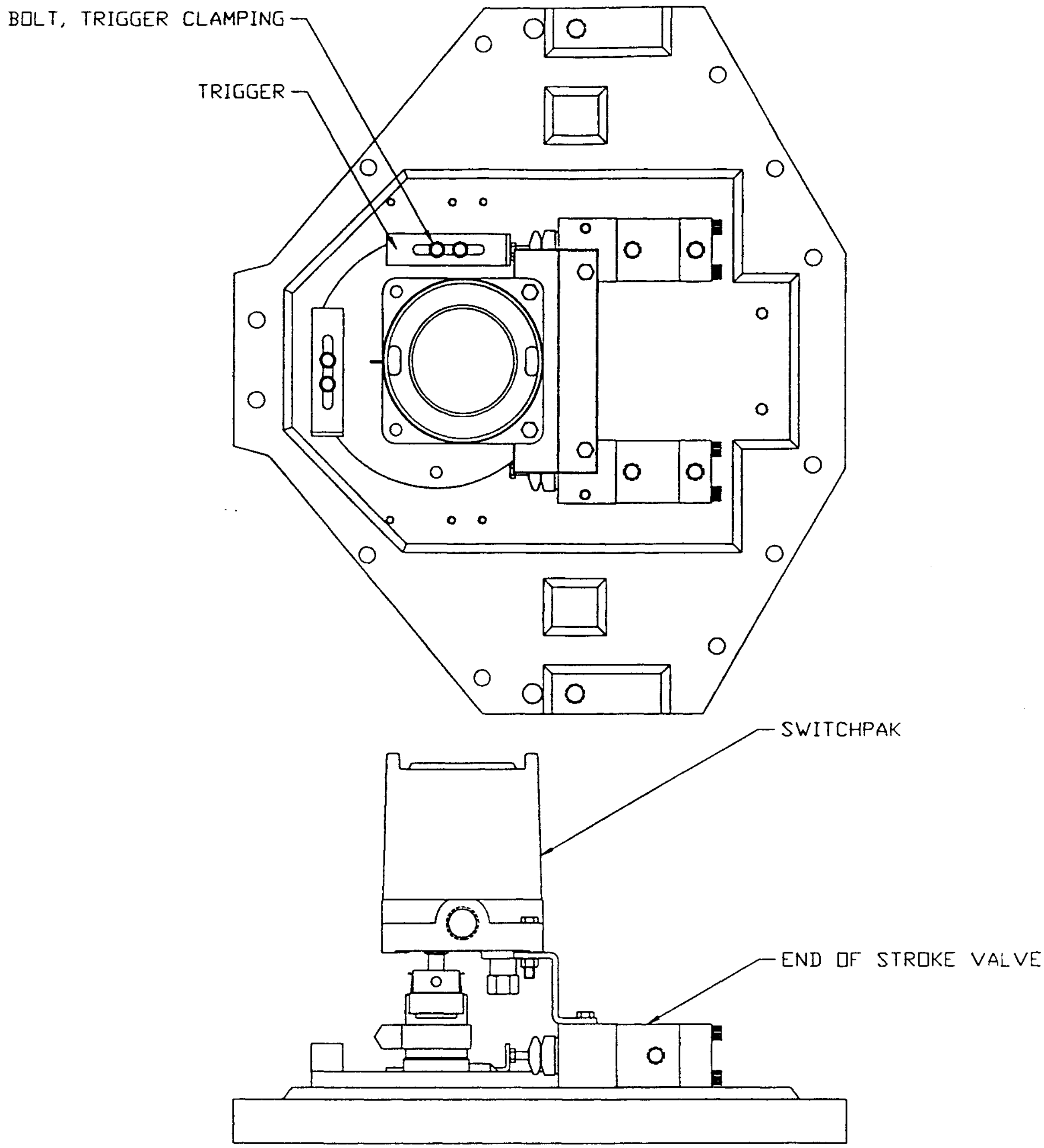
4. Install trigger, with bolts hand tight so trigger can be slid forward to actuate trigger valve.

5. Holding trigger in position such that trigger valve has switched and sealed, tighten bolts.

6. Operate operator to check trigger valve operation. At the end of the stroke the trigger valve should switch and seal properly.

7. If trigger valve is not sealing properly after operation, loosen bolts, adjust trigger forward a little, re-tighten.

APPROXIMATELY 1/4 inch [6 mm] OF TRIGGER TRAVEL IS MINIMUM REQUIRED.



+WSHS TO TRIGGER, UPDT LOGO
2 AS-1998-04-27 @ 6053-1-B
+DESCRIPTIONS
1 RS-1995-03-06@SERV REQ

REV BY-DATE+REF

MATERIAL/FINISH

UNLESS SPECIFIED OTHERWISE
ALL DIMENSIONS INCHES [mm]

TOLERANCES

DECIMALS	RMS	FRACTIONS
.X ±0.05	500	XX-X/X ±1/16
.XX ±0.02	250	X-X/X ±1/32
.XXX ±0.005	125	X/X ±1/64
T.I.R. ±0.010	THD ±1 TURN	∠ ±1°

BREAK SHARP EDGES
CHAMFER FIRST THREAD
REMOVE ALL BURRS

BETTIS BETTIS CANADA LTD.
Actuators & Controls
A Daniel Industries Company

TYPICAL LIMIT SWITCH LAYOUT
FOR SWITCHPAK
WITH END OF STROKE VALVE

I-0046--.DWG APR-27-98		WEIGHT N/A	
SCALE 1:5	BY VL	CHK [illegible]	DATE FEB-06-95
W.O. 07482-1-G		DWG. NO. I-0046	REV 2-

X OPERATOR MAINTENANCE

Refer to Operator Cutaway drawing on page 22.

BETTIS SERIES:	Series 7	Series 6	Series 5	Series 3	Series 2
BETTIS MODEL:	67 DH	46 DH	45 DH	23 SH	12 SH
	77 DH	56 DH	55 DH	33 DH	22 DH
	87 DH	66 DH	65 DH	43 DH	
	97 DH			53 DH	
	107 DH				

The operator has a hydraulic cylinder at each end of the drive case. A scotch yoke mechanism is used to convert the linear piston motion to quarter turn rotation.

The only servicing normally expected is soft parts replacement. Only cylinder disassembly is required to replace the parts below. For each cylinder:

ITEM	DESCRIPTION		QTY
25	O-ring	- END STOP COVER	1
26	O-ring	- PISTON CENTRE	1
27	"polypak"	- DRIVE ROD	1
28	O-ring	- CYLINDER	2
29	"polypak"	- PISTON	2
36	“polypak”	- CYLINDER PLATE	1

TOOLS AND EQUIPMENT REQUIRED ARE:

a) For Series 2
- 1-1/8 Hex socket and long extension
- 15/16 Impact or hammer wrench
- 7/8 Impact or hammer wrench

b) For Series 3
- 1-1/2 Impact or hammer wrench
- 1-1/2 Hex socket and long extension
- 3/8 Socket Hex Key

c) For Series 5
- 2-1/4 Impact or hammer wrench
- 2-1/4 Hex socket and long extension
- 1/2 Socket Hex Key

d) For Series 6
- 2-1/2 Impact or hammer wrench
- 2-3/8 Hex socket and long extension
- 5/8 Hex Key

e) For Series 7
- 3-1/8 Impact or hammer wrench
- 3-1/8 Hex socket and long extension
- 3/4 Hex Key

Other tools that are also required include:

- A set of standard imperial size wrenches and sockets through 1-1/2" Hex keys, size 1/16" through 5/8"
- A pair of 8" or longer screwdrivers
- A container, funnel, 10 micron filter, flexible hose and fittings to drain and salvage hydraulic fluid.
- Solvent (eg. Varsol)
- Sealant (eg. Silicone)
- Lubricant (petroleum grease, petroleum jelly, hydraulic fluid)
- Anaerobic adhesive (eg. "Loctite")

XI OPERATOR DISASSEMBLY

Refer to "Operator Specifications" on page 25 for bolt and nut torque values for your model.

1. Shut off power gas supply; disarm automatic control and blowdown power gas.

2. Remove valve stem key to disconnect operator from valve.

3. END STOP SEAL REPLACEMENT at either end of operator:

   Using the handpump stroke operator against the stop, remove end stop cover, then replace o-ring. Replace cover and tighten.

   NOTE: When end stop cover is removed, some fluid will run out.

4. To facilitate stroking for cylinder fluid removal, for repairs, isolate one side of the TEE location of piping to the cylinder ports. Connect flexible hoses to the ports of the cylinder to be repaired. Using handpump cycle the operator to push the fluid from the cylinder. Leave the operator in the position such that the piston bolt is against the end stop of the cylinder to be repaired.

   NOTE: If necessary to remove all piping, speed control valves will hold fluid in the tanks if turned down.

A. CYLINDER DISASSEMBLY

   1. Mark the cylinder parts for reinstallation on the same end and orientation of the operator.

   2. Remove stay rod nuts, and end cap (it is not necessary to remove end stop and cover if no seal is replaced).

   3. Remove some stay rods for access to cylinder and piston.

   4. Slide cylinder back off piston.

   5. Remove piston bolt / nut, piston and seals.

6. Remove cylinder plate ring, cylinder plate bolts and cylinder plate itself. Note the location and number of seals.

7. Remove drive rod seal (polypak) from cylinder plate.

   NOTE: There is no drive rod seal in the drive case, only a guide.

ALL PRESSURE CONTAINING PARTS CAN NOW BE INSPECTED AND REPLACED AS NECESSARY. IT IS GOOD PRACTICE TO REPLACE ALL SEALS EVEN IF THEY APPEAR SERVICEABLE. PROCEED WITH CYLINDER ASSEMBLY STEP (9) BELOW, UNLESS COMPLETE DISASSEMBLY IS REQUIRED.

B. DRIVE CASE DISASSEMBLY

8. Remove 10 cover cap screws and lift off the drive case cover.

9. Remove tanks, allowing entry to access hole for lower snap ring removal if necessary.

10. Remove the 2 drive pin snap rings, drive pin and rollers. Lift lower roller for best access to lower snap ring (Series 3 and Series 6 drive pin with its lower snap ring is removed through the access hole in bottom of drive case).

11. Slide the drive rod out of the drive case, careful to avoid damage to the drive rod surface.

12. Lift out the yoke and upper and lower bushings and bearings. Upper bushing may lift off with the cover.

13. Clean and inspect all parts; replace if necessary.

XII OPERATOR ASSEMBLY

NOTE: Gas / Hydraulic tanks should be drained and flushed if fluid is contaminated with scale, rust, particulates, water, foam, or etc. Flush only with hydraulic fluid. Refill with filtered fluid.

A. DRIVE CASE ASSEMBLY

1. Install drive rod guides and lubricate with petroleum jelly.

2. Install yoke lower thrust bearing, all models, and upper thrust bearing to yoke when provided for valve stem horizontal. Lubricate with grease.

3. Install upper yoke bushing and o-ring in cover, lower yoke bushing in drive case, lubricate with grease.

4. Lower yoke into drive case.

5. Install drive rod into drive case.

6. Install drive rollers in yoke slots, drive pin through drive rod and rollers, snap rings to retain. Lubricate with petroleum grease. (Series 3 and Series 6 drive pin with its lower snap ring is installed through access hole in bottom of drive case.)

   NOTE: Check that snap rings are seated.

7. Install drive case cover, using sealant around perimeter inside bolt pattern to make it weather tight. TORQUE BOLTS TO SPECIFICATION.

8. Replace tanks with handpump and manifold assembly.

B. CYLINDER ASSEMBLY

9. Install drive rod seal in cylinder plate, and slide cylinder plate over drive rod into position with port in correct orientation.

10. Install, tighten, and TORQUE cylinder plate bolts.

11. Install cylinder plate ring(s) and 2 different seals.

12. Lubricating with hydraulic fluid, install wear ring and replace piston seals on piston with seal lip facing outwards. Insert into cylinder using tapered compression tool, or install seals one at a time with each groove in turn protruding from cylinder. Press piston back into cylinder in position to match drive rod position.

13. Install piston centre o-ring in piston.

14. Slide piston / cylinder unit on drive rod, against cylinder plate / ring taking care that parts / seals remain in correct position and alignment. Piston centre seal faces drive rod.

15. Apply anaerobic adhesive on threads, install, tighten and TORQUE piston nut / bolt.

16. Install stay rods.

17. Install cylinder o-ring on end cap and install end cap with port in correct orientation.

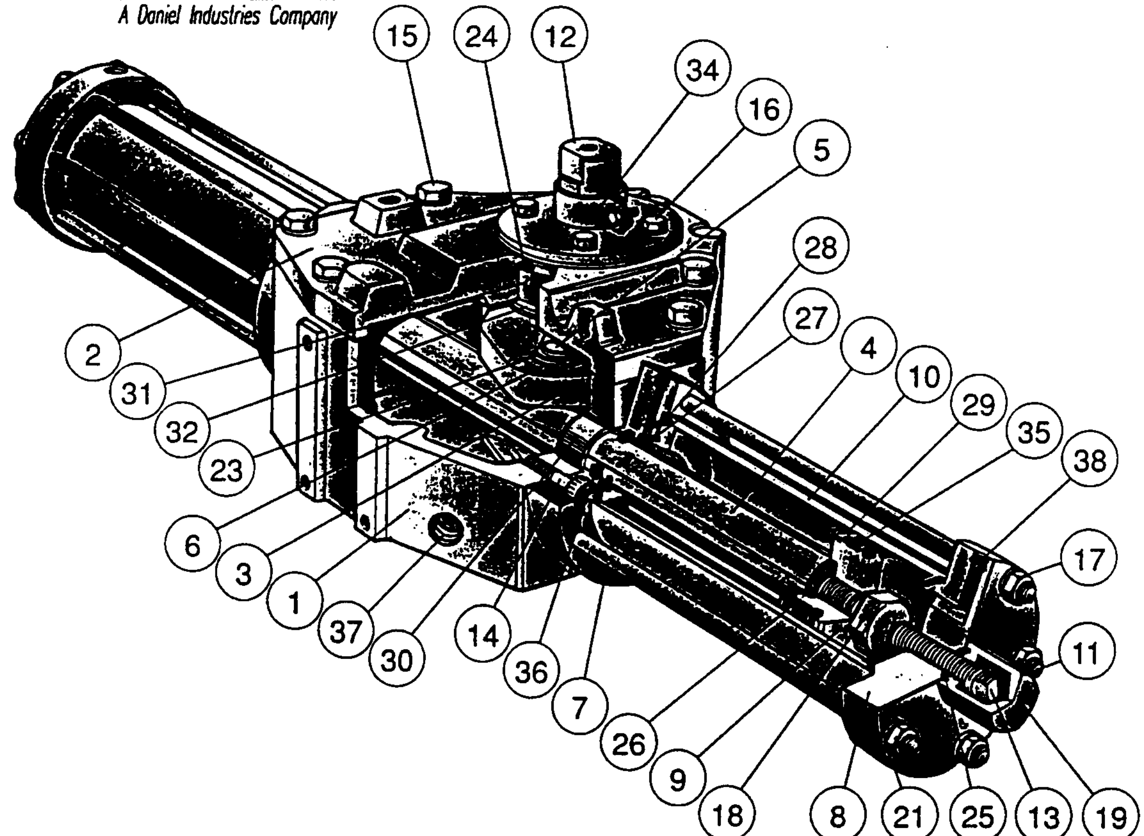
18. Install stay rod nuts and tightening evenly; TORQUE TO SPECIFICATION.

19. Reconnect piping, cycle unit with handpump to refill cylinders with fluid. Add fluid to tanks to obtain correct levels for operator positions.

20. Hydrostatic test with handpump. Refer to page 14 item 6.

21. Replace stem key, yoke cover and gasket, and position flag indicating correct valve position.

BETTIS
Actuators & Controls
A Daniel Industries Company



Typical Gas/Hydraulic Parts List (Quarter-Turn Operators)

Material specifications are typical for operation at -50°F to 150°F (-46°C to 65°C)

Item	Description	Material	Qty	Note
1	Drive Case	Tenzaloy 713	1	
2	Cover	Tenzaloy 713	1	
3	Yoke	ASTM A148 or DI	1	
4	Drive Rod	AISI 4140	1	(C)
5	Drive Pin	AISI 4140 Heat Treated	1	
6	Drive Roller	AISI 4140 Carburized	2	
7	Cylinder Plate	ASTM A516-70	2	
8	End Cap	ASTM A516-70	2	
9	Piston	ASTM A516-70	2	
10	Cylinder	C1026	2	
11	Tie Rod	AISI 4140	16	(V)
12	Yoke Cover	Tenzaloy 713	1	
13	End Stop	ASTM A193 Gr. B7	2	
14	Cylinder Plate Capscrew	SAE Gr. 5 Plated	6	(V)
15	Cover Capscrew	SAE Gr. 5 Plated	10	
16	Yoke Cover Capscrew	SAE Gr. 5 Plated	4	
17	Tie Rod Nut	ASTM A194 Gr. 2H	16	
18	Piston Capscrew	SAE Gr. 8 Plated	2	(V)
19	End Stop Cover	ASTM A194 Gr. 2H	2	
21	Tie Rod Lockwasher	SAE 1060 Plated	16	(V)
23	Snap Ring	SAE 1075 Heat Treated	2	
24	Yoke O-Ring	Nitrile	1	(Y)
25	End Stop O-Ring	Nitrile	2	(Y)
26	Piston Centre O-Ring	Nitrile	2	(Y)
27	Drive Rod Seal	Urethane/MoS_2 /Nitrile	2	(Y)
28	Cylinder O-Ring	Nitrile	4	(Y)
29	Piston Seal	Urethane/MoS_2 /Nitrile	4	(Y)

Item	Description	Material	Qty	Note
30	Drive Rod Guide	Acetal	2	
31	Yoke Bushing	C1020	2	(C)
32	Yoke Bearing	Nylon	1	
34	Position Indicator	C1010	1	
35	Piston Wear Ring	Nylon/MoS_2	2	
36	Cylinder Plate Polypak	Molythane	2	(Y)
37	Inspection Hole Plug	Polyethylene	1	(V)
38	NPT Port		4	

Pressure Vessels (N)

a)	-50°F to 150°F (-46°C to 65°C)	Shell	ASME SA-333 Gr. 6	(**)
		Head	ASME SA-420-WPL6/ ASME SA-516-70	
		Fittings	ASME SA-350-LF2	
b)	-20°F to 150°F (-29°C to 65°C)	Shell	ASME SA-106 Gr. B	
		Head	ASME SA-234-WPB/ ASME SA-516-70	
		Fittings	ASME SA-105/ ASME SA-350-LF2	

Notes:

(C) Chrome Plated
(N) Not Shown
(Y) Spare Parts Kit
(V) Quantity may vary depending on model
(**) Impact tested as per ASTM A370
18J average, 14J minimum, -50°F(-46°C), CVN full size

All metal parts coated with corrosion inhibitor
All specifications are subject to change or upgrade

XIII FLUID MAINTENANCE GUIDE

The hydraulic fluid is an important component of each BETTIS Gas / Hydraulic operator system. An aviation grade hydraulic fluid (ESSO UNIVIS or EQUIVALENT) is used unless Customer has specified otherwise. Contact the factory for suitable Gas / Hydraulic system compatible hydraulic fluids.

1. Do not add automatic transmission fluid, brake fluid, methanol or any other solvent to the fluid as it can damage the seals of some internal components. Flush the system with recommended fluid only.

2. Operators / systems that cycle more than 2-3 times per week (unit suction / discharge; pig launcher / receiver block valves) should have the fluid changed, or at least monitored / analyzed when volume and expense of fluid or disposal warrants, ANNUALLY.

3. For Gas / Hydraulic systems, at least ONCE PER YEAR:

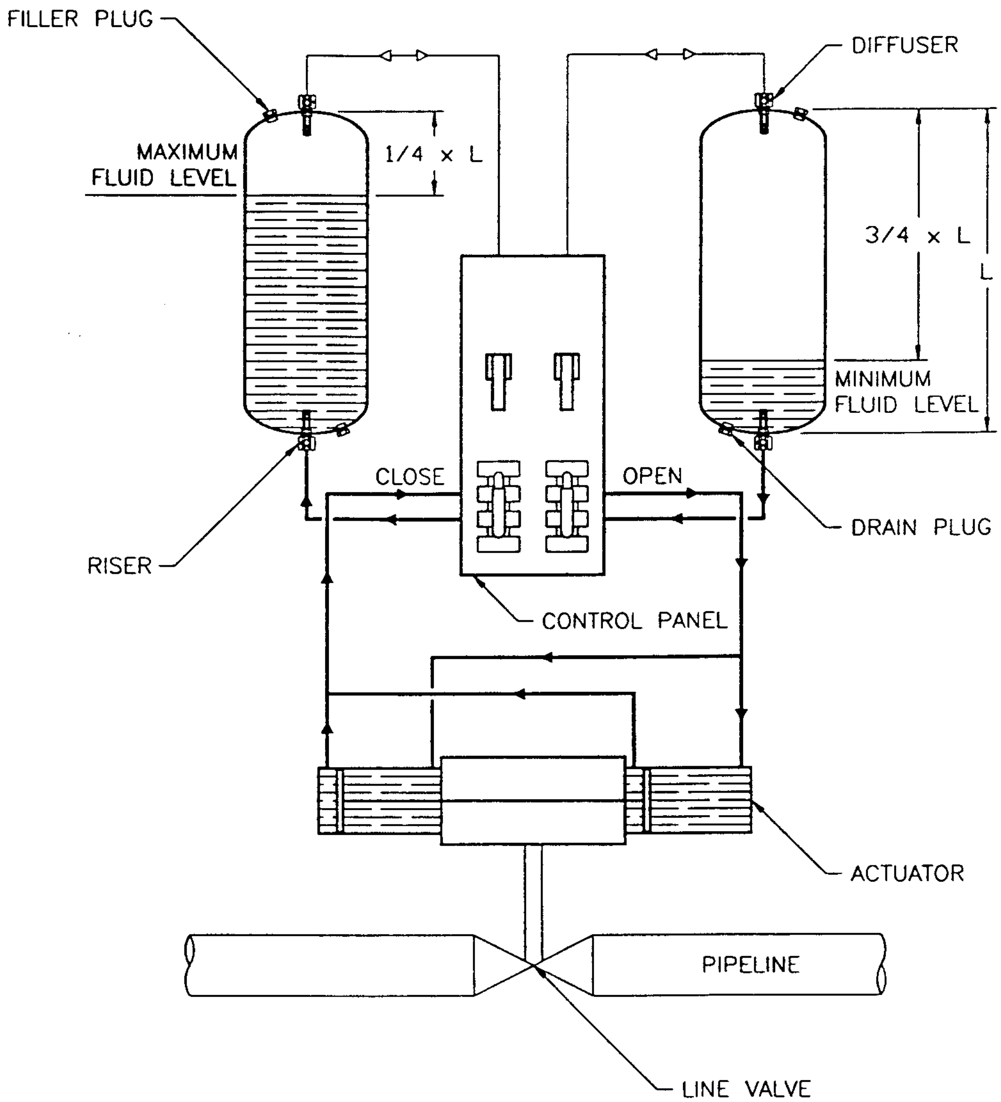
   a) The power gas filter should be drained of contaminants and if heavy liquid contamination is evident, the Gas / Hydraulic tanks should be drained of contaminants and levels checked

   b) The fluid may be filtered or gravity separated if the contamination is light.

   c) Levels should be checked, fluid added to make-up the correct level for given line valve / operator position. Refer to I-0006-13 on page 24.

XIV HYDRAULIC FLUID SPECIFICATIONS

Temperature Rating	Low (-50°C to 65°C)	Standard (-20°C to 77°C)
Specific Gravity at 15°C	0.85	0.88
Kinematic Viscosity “centistokes” at -65°F (-54°C) at -40°F (-40°C) at 100°F (38°C) at 212°F (100°C)	 2,300 460 14 5	 -- 6,000 25 5.6
Viscosity Index	380	200
Pour Point, °C	-60	-50
Flash Point, °C	105	166
Color	Red	Yellow



NOTE:

1. AN AVIATION GRADE HYDRAULIC FLUID (ESSO UNIVIS OR EQUIVALENT) IS USED IN ALL 'BETTIS' OPERATOR SYSTEMS; OR PER CUSTOMER REQUEST
2. MINIMUM AND MAXIMUM FLUID LEVELS REFER TO CONDITIONS AT FULL OPEN OR CLOSED VALVE POSITION
3. DRAIN ACCUMULATED MOISTURE AND CONTAMINANTS BY PLUGGING BOTTOM TUBE CONNECTION AND LOOSENING RISER FITTING IF DRAIN PLUG NOT AVAILABLE

LEGEND

- POWER GAS
- HYDRAULIC
- ELECTRICAL
- FIELD CONNECTION
- PLUGGED PORT
- SIGNAL
- INSTRUMENT
- RETURN
- VENT
- CLOSED
- OPEN

BETTIS Actuators & Controls
A Daniel Industries Company

BETTIS CANADA LTD.

GAS/HYDRAULIC
TANK FILLING

SCALE N/A	BY MN	CHK	DATE JUN-06-92
W.O. ---		DWG. NO. I-0006-13	REV 4-

I-0006--.DWG_VIEW_13
APR-28-98

UPDT LOGO
4 AS-1998-04-27 @ 6053-1-B
REDRAW, UPDT STDS
3 RS-1997-10-23 @ 6053-1-B
UPDT PLUGS
2 RS-1995-03-23 @ ASSEMBLY
UPDT FLUID TYPE
1 PL-1992-12-30 @ SALES
REV BY-DATE+REF

XV OPERATOR SPECIFICATIONS

A. SERIES 2 OPERATOR

BOLT/NUT TORQUE (FT.LB)	MODEL	
	12 SH	22 DH
COVER BOLTS	30	30
CYL. PLATE BOLTS	45	45
PISTON NUT/BOLT	N/A	260
STAY ROD NUTS	N/A	75
MTG. PLATE BOLTS	75	75

B. SERIES 3 OPERATOR

BOLT/NUT TORQUE (FT.LB)	MODEL			
	23 SH	33 DH	43 DH	53 DH
COVER BOLTS	76	76	76	76
CYL. PLATE BOLTS	100	100	100	100
PISTON NUT/BOLT	-	600	600	600
STAY ROD NUTS	80	80	80	80
MTG. PLATE BOLTS	120	120	120	120

Maximum engagement of 5/8NC bolts into drive case is 1-3/8 INCH.

OPERATOR	SERIES 3 MODEL			
	23 SH	33 DH	43 DH	53 DH
M.A.W.P. (psi)	1500	1500	1500	1440
STROKING TIME (seconds)	1	3	5	8
WEIGHT (lbs)	450	550	650	750
FLUID CAPACITY (US gals)	1.5	1.5	2	3

C. SERIES 5 AND SERIES 6 OPERATORS

BOLT/NUT TORQUE (FT.LB)	SERIES 5 MODEL			SERIES 6 MODEL		
	45 DH	55 DH	65 DH	46 DH	56 DH	66 DH
COVER BOLTS	76	76	76	76	76	76
CYL. PLATE BOLTS	100	100	100	110	110	110
PISTON NUT/BOLT	1500	1500	1500	1500	1500	1500
STAY ROD NUTS	80	80	100	100	100	100
MTG. PLATE BOLTS	120	120	120	120	120	120

Maximum engagement of 5/8NC bolts into drive case is 1-1/2 INCHES.

OPERATOR	SERIES 5 MODEL			SERIES 6 MODEL		
	45 DH	55 DH	65 DH	46 DH	56 DH	66 DH
M.A.W.P. (psi)	1500	1500	1440	1500	1500	1500
STROKING TIME (seconds)	8	10	13	8	10	12
WEIGHT (lbs)	950	1050	1300	950	1050	1300
FLUID CAPACITY (US gals)	4	4	6	5	6	8

D. SERIES 7 OPERATOR

BOLT/NUT TORQUE (FT.LB)	MODEL					
	67 DH	77 DH	87 DH	97 DH	107 DH	107 DH-8BX
COVER BOLTS	180	180	180	180	180	180
CYL. PLATE BOLTS	350	350	350	350	350	350
PISTON NUT/BOLT	2400	2400	2400	2400	2400	2400
STAY ROD NUTS	180	300	300	300	300	300
MTG. PLATE BOLTS	350	350	350	350	350	350

Maximum engagement of 1NC bolts into drive case is 1-3/4 INCHES.

OPERATOR	MODEL					
	67 DH	77 DH	87 DH	97 DH	107 DH	107 DH-8BX
M.A.W.P. (psi)	1500	1500	1500	1500	1440	1440
STROKING TIME(seconds)	9	11	24	25	30	30
WEIGHT (lbs)	2200	2700	3400	3500	3800	4000
FLUID CAPACITY (US gals)	8	11	15	17	18	20

XVI OPERATOR REPAIR KITS

NOTE: Please provide the - MODEL identification and unit
- SERIAL NO. when ordering operator repair parts.
(The W.O. number from Gas / Hydraulic tank tag will help and may suffice if no other information if obtainable. Any other identification cast into drive case cover or stamped on manufactured metal parts may help if all else fails and location is noted or sketched).

Description - Operator Repair Kit - Minor Soft Parts

Description	Material	Qty
O-Ring, Yoke	Nitrile	1
O-Ring, Piston Center	Nitrile	2
O-Ring, Cylinder Ring	Nitrile	2
O-Ring, End Stop	Nitrile	2
Polypak, Drive Rod	Molythane	2
O-Ring, Cylinder	Nitrile	4
Polypak, Piston	Molythane	4

Description - Operator Repair Kit - Major

Description	Material	Qty
Piston Wear Ring	Nylon / MoS2	2
Drive Rod Guide	Acetal	2
Yoke Bushing	AISI C1020 / Acetal	2
Yoke Bearing	Nylon	2

In addition all soft parts from Minor Kit would be included.

Description - Control Package Component Repair Kits

See specific component drawings in service manual for indicated spare parts kits.

XVII TROUBLE SHOOTING

Of all the system components the OPERATOR itself is the least likely to malfunction, and requires the most time and effort to service. For this reason a thorough effort should be made to pinpoint the source of trouble before proceeding with operator service.

Completion of the operational test steps page 14 should confirm satisfactory operation or indicate the most likely source of a problem.

PROBLEM	POSSIBLE CAUSES	REMEDY
Slow jerky or partial stroke on manually controlled gas powered	-Low supply pressure -Shutoff / speed control closed -Dirty gas filter element resulting in insufficient flow and pressure to stroke operator -Contaminated fluid; will not flow easily through lines. -Operator and valve stops not in same position.	-Check and increase -Check and open a few turns -Blow out lines -See "Maintenance and Operational Testing". -Disconnect operator from valve if possible.
Slow or no operation with handpump.	-Tank fluid levels low -Pump suction or discharge check valve malfunction -Speed control or locking valve blockage / malfunction -Dirt, ice in fluid lines	-Make up levels with aviation grade hydraulic fluid (ESSO UNIVIS or EQUIVALENT; or per customer specification). -See "GENERAL SERVICE" -Remove tubing at cylinder -Check for flow when handpump operated.
Fluid leaking from drive case vents - ROTARY Fluid leaking from cylinder plate - GVO Fluid leaking from END STOP COVER SEAL Excessive amounts of fluid from / with exhaust	-Damaged rod seal -Damaged seal -High tank levels -Blow by across piston	-See "OPERATOR SERVICE" -See "OPERATOR SERVICE" re end stop seal replacement -Check levels -See "MAINTENANCE AND OPERATIONAL TESTING" Manual operation with handpump

XVIII GENERAL SERVICE NOTES

Refer to schematic drawing and list of components at the end of this document and testing and trouble shooting on pages 14 and 28 respectively..

The following pages contain information on the components identified on the schematic drawing of a BETTIS Gas / Hydraulic Rotary or Gate Valve Operator.
Information on additional optional components as specified by users, is at the end of this manual.

Please provide operator serial number if ordering spare parts.

ITEM NO.	COMPONENT
1A	Bettis ROTARY OPERATOR Operates quarter turn valve. Refer to "Operator Service".
1B	Bettis LINEAR OPERATOR Operates gate valves. Refer to "Operator Service".
3	GAS / HYDRAULIC TANKS For pressure transfer. Refer to I-0006-13 on page 24. Drain accumulated moisture and contaminants. An aviation grade hydraulic fluid (ESSO UNIVIS or a suitable equivalent) is used in all Bettis operator systems; or per customer request.
4	Bettis RELAY MODEL 324-M Lever operated to direct power gas to GAS / HYDRAULIC TANK. Soft parts replacement is required. Refer to cutaway drawing and parts list.
5	Bettis RELAY MODEL 324-DM Lever or diaphragm operated to direct power to GAS / HYDRAULIC TANK. Soft parts replacement is required. Refer to cutaway drawing and parts list.
6	Bettis HYDRAULIC SELECTOR VALVE Lever operated to select flow direction of hydraulic fluid. Drain GAS / HYDRAULIC TANK below selector valve level if valve must be removed. Refer to cutaway drawing and parts list.
7	SPEED FLOW CONTROL VALVE A variable restriction which allows for independent control of opening and closing speed.
8	MANIFOLD CHECK VALVES Prevents interflow between tanks. Refer to "manifold assembly" drawing.
9	Bettis HANDPUMP Manual operation without power gas. Plunger seal and wiper may be easily replaced. Specify model HV-# or HP-# when ordering.

10 GAS FILTER
Power gas filtration and liquids dropout. Blow down moisture and contaminants as required. Filter element may be replaced. Refer to cutaway drawing and parts list.

12 REGULATOR
Provide signal gas for devices operating at 700 KPa (100 psig). On some models the seat block may be rotated to bring a new seating surface into use.

13 RELIEF
Signal gas overpressure protection.

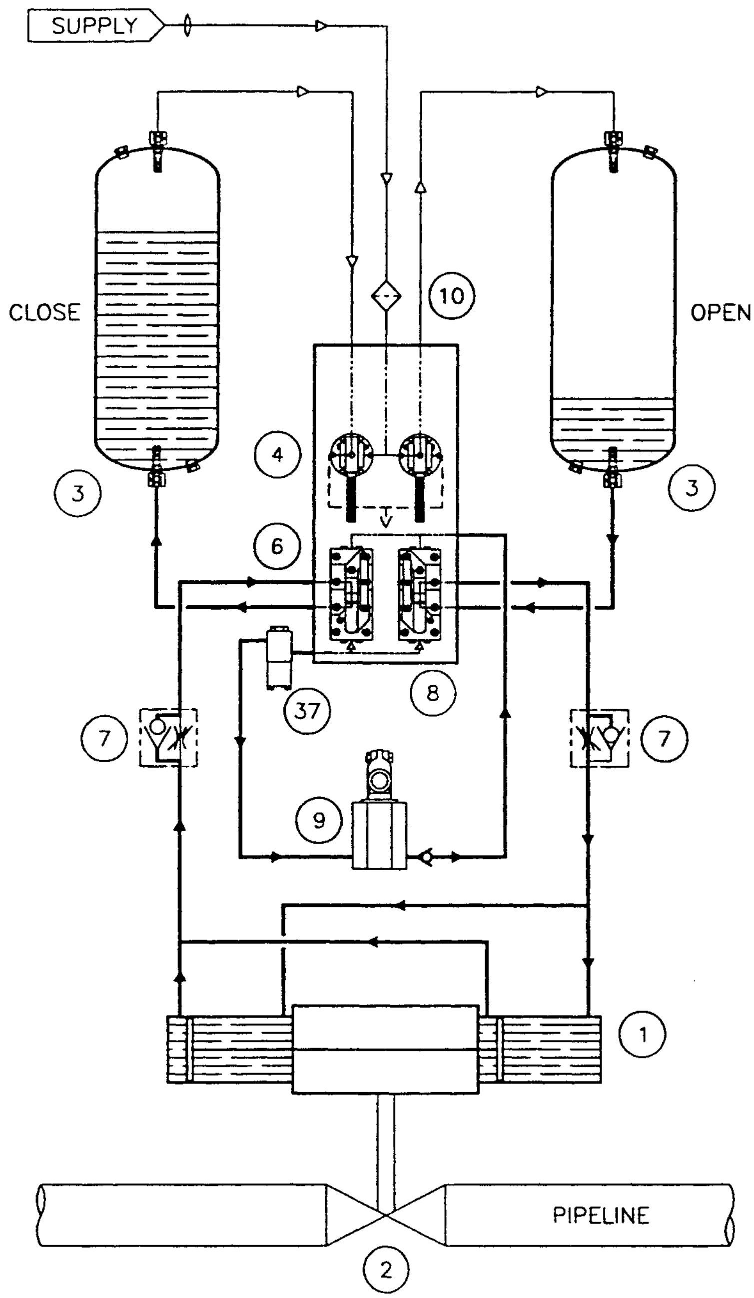
15 END OF STROKE VALVE (trigger valve; N.O. relay)
Cam operated at end of stroke to vent power gas. Normally only soft parts replacement is required. Refer to cutaway drawing and parts list.

17 LIMIT SWITCH
Electrical indication of valve status. Consult limit switch bulletin for service and adjustments. Specify make and model when ordering parts.

37 HANDPUMP SAFETY VALVE
Protection against handpump actuation when accidentally operating with power gas with open or close hydraulic selector valve positioned in handpump mode.

LIST OF COMPONENTS:

1	OPERATOR
2	LINE VALVE
3	GAS/HYDRAULIC TANK
4	3-WAY VALVE, MANUAL
6	SELECTOR VALVE
7	SPEED CONTROL VALVE
8	CHECK VALVE
9	HANDPUMP
10	FILTER
37	HANDPUMP SAFETY VALVE



LEGEND

- POWER GAS
- HYDRAULIC
- ELECTRICAL
- FIELD CONNECTION
- PLUGGED PORT
- SIGNAL
- INSTRUMENT
- RETURN
- VENT
- CLOSED
- OPEN

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BETTIS CANADA LTD.

GAS/HYDRAULIC OPERATOR
TWO WAY MANUAL
SHOWN IN POWER GAS MODE

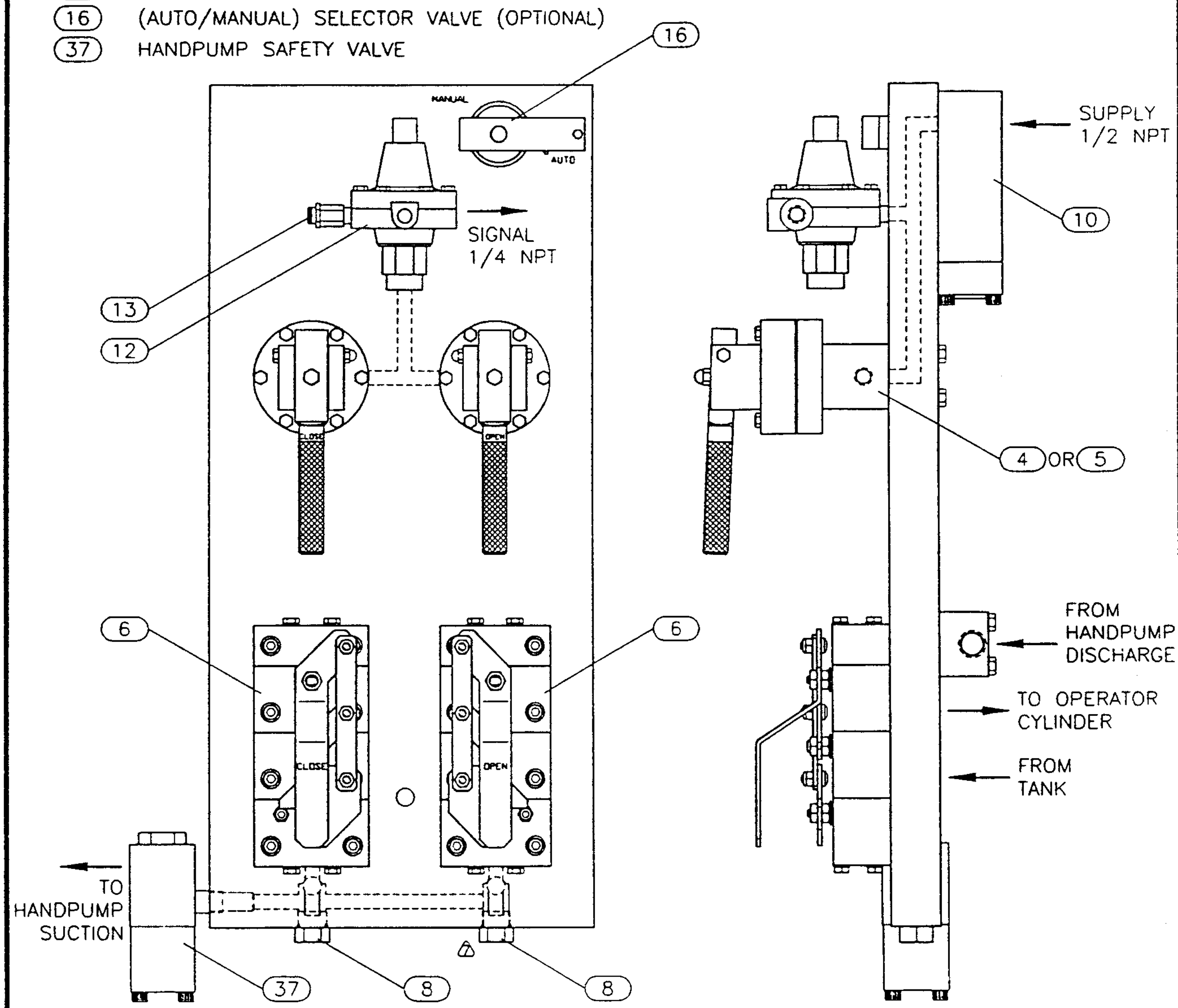
SCALE	BY	CHK	DATE
N/A	KN	[illegible]	JUN-09-92

W.O.	DWG. NO.	REV
---	C-0201-03	2-

UPDT LOGO
2 AS-1998-04-27 @ 6053-1-B
UPDT TITLE BLOCK
1 RS-1998-02-02 @ 06051-1-B
REV BY-DATE+REF

C-0201--.DWG_LAYER_DUAL
APR-28-98

ITEM	DESCRIPTION
4	3-WAY VALVE (MANUAL)
5	3-WAY VALVE (MANUAL/PILOT)
6	SELECTOR VALVE
8	CHECK VALVE (BALL, SPRING, PLUG, O-RING)
10	FILTER
12	PRESSURE REGULATOR (OPTIONAL)
13	RELIEF VALVE (OPTIONAL)
16	(AUTO/MANUAL) SELECTOR VALVE (OPTIONAL)
37	HANDPUMP SAFETY VALVE



UNLESS SPECIFIED OTHERWISE
ALL DIMENSIONS INCHES [mm]

AD'D CHECK VALVE DETAIL
7 RB-1998-04-01 @ 06053
ITEM No. 37 WAS 20 IN ERROR
6 RS-1998-01-27 @ 06053-1-3
REDRAW, UPDT STDS
5 RS-1997-10-23 @ 06053-1-3
SHOW P-1-DD BOWL
4 RS-1995-03-29 @ A.S REG
REV BY-DATE+REF

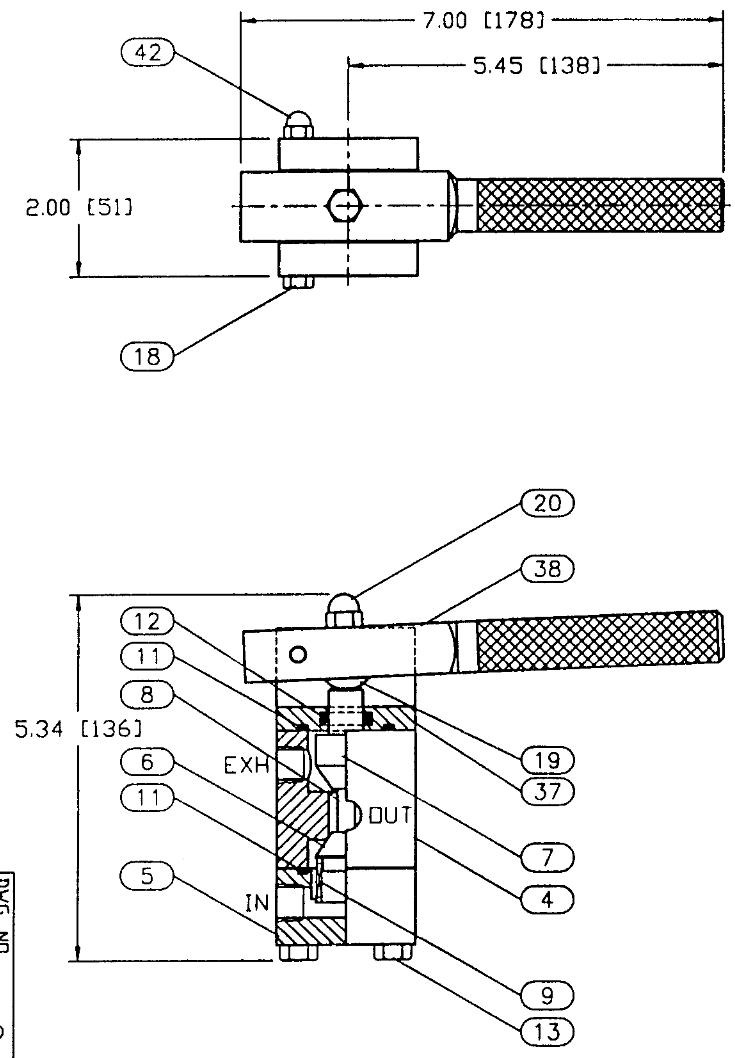
TOLERANCES
XXX ±0.5 [±10]
XX ±0.2 [±5]
X ±0.1 [±2]

BETTIS CANADA LTD.
BETTIS Actuators & Controls
A Daniel Industries Company

TYPICAL MANIFOLD ASSEMBLY
FOR GAS/HYDRAULIC OPERATOR

A-0197--.DWG_VIEW_00
APR-01-98

SCALE 1:5	BY EB	CHK N-1998-04-01	DATE JUN-10-91
W.O. ---		DWG. NO. A-0197	REV 7-



ITEM	PART NO.	DESCRIPTION	MATERIAL	QTY	NOTE
4	324-004	UPPER BODY	AL 6061-T6	1	
5	324-005	LOWER BODY	AL 6061-T6	1	
6	324-006	POPPET, LOWER	PVC	1	(Y)
7	324-007	POPPET, UPPER	PVC	1	(Y)
8	324-008	POPPET SPACER	DOWEL PIN	1	
9	324-009	SPRING	SS	1	
11	324-011	O-RING, BODY	BUNA N	2	(Y)
12	324-012	O-RING, POPPET	BUNA N	1	(Y)
13	324-013	CAPSCREW, BODY	HXHC GR. 5 ZN.PL	4	
18	324-018	CAPSCREW, OPERATOR	HXHC GR. 5 ZN.PL	1	
19	324-019	ROUNDHEAD PUSH BOLT	RHSN GR. 5 ZN.PL	1	
20	324-020	NUT, LEVER	GR. 5 ZN.PL	1	
37	324-037	'M' CYLINDER PLATE	AL 6061-T6	1	
38	324-038	'M' LEVER	AL 6061-T6	1	
42	324-042	NUT, OPERATOR	GR. 5 ZN.PL	1	
--	700-106	NAMEPLATE, SPECIAL TRIM	SS 304	1	

NOTE: (Y) RECOMMENDED SPARE PARTS, PART NO. SPRK-A324-M
FASTENERS AND MAINTENANCE TOOLS ARE ANSI/INCH SIZE
RECOMMENDED MAXIMUM 20 PSIG BACK PRESSURE AT EXHAUST PORT
FOR MANIFOLD MOUNTING, LOWER BODY (5) OMITTED
FOR STANDARD USE, NAMEPLATE OMITTED

SPECIFICATIONS:
PORTS: 1/4 NPT
SERVICE: AIR, SWEET GAS, < 5% H_2S SOUR GAS
TEMP. RATING: -50°C THRU 120°C
MASS: 2.2 LBm [1.0 kg]
MAWP: 1500 PSIG

UNLESS SPECIFIED OTHERWISE
ALL DIMENSIONS INCHES [mm]

UPDT LOGO
AS-1998-04-28 @ 6053-1-B
EDITORIAL CORRECTION
RS-1996-12-03 @ SALES
UPDT STDS, ADD NAMEPLATE
VL-1996-04-01 @ 7482-1-B
REDRAW CAD, UPDT BOM
JY-1992-12-18 @ SALES
REV BY-DATE+REF

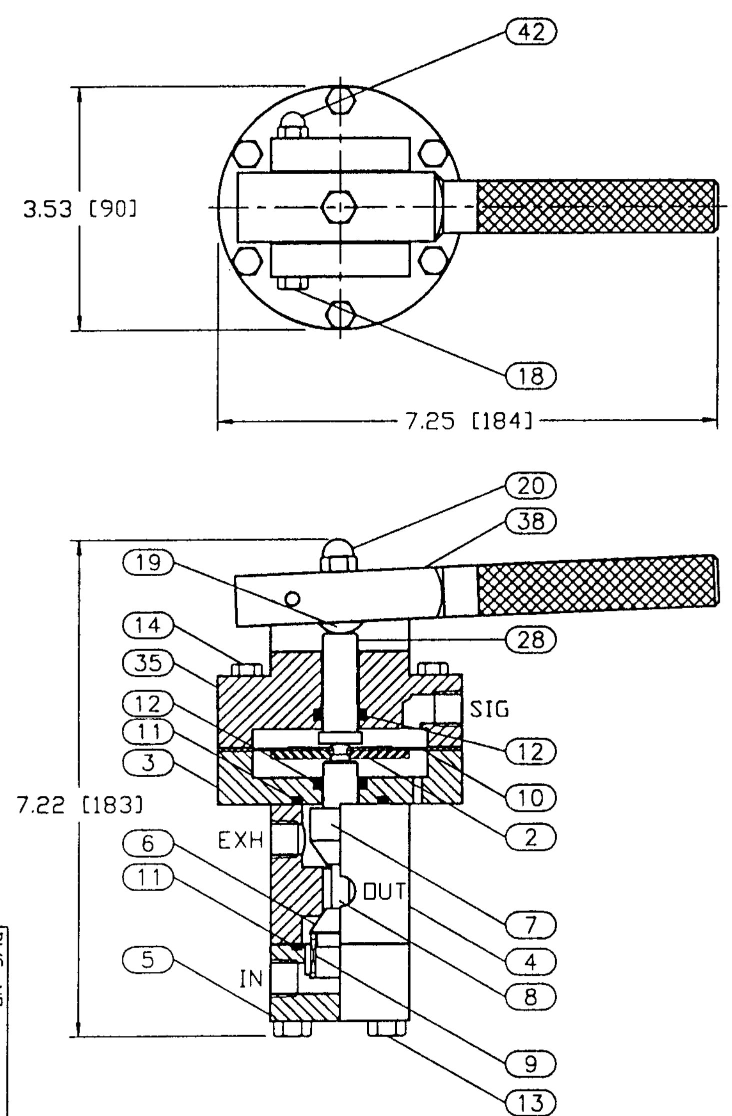
TOLERANCES
XXX ±0.5 [±10]
XX ±0.2 [±5]
X ±0.1 [±2]

BETTIS Actuators & Controls
A Daniel Industries Company
BETTIS CANADA LTD.
MODEL A324-M SWITCHING RELAY
(3-WAY, 2-POSITION)

C-0032--.DWG_VIEW_00
APR-28-98

WEIGHT	SEE ABOVE				
SCALE 3:8	BY TS	CHK MAYYE..04-28	DATE NOV-01-80		
W.D. ---	DWG. NO. C-0032	REV 6-			

DWG. NO. C-0032



ITEM	PART NO.	DESCRIPTION	MATERIAL	QTY	NOTE
2	324-002	DIAPHRAGM PLATE	AL 6061-T6	1	(Y)
3	324-003	CYLINDER PLATE	AL 6061-T6	1	
4	324-004	UPPER BODY	AL 6061-T6	1	
5	324-005	LOWER BODY	AL 6061-T6	1	
6	324-006	POPPET, LOWER	PVC	1	(Y)
7	324-007	POPPET, UPPER	PVC	1	(Y)
8	324-008	POPPET SPACER	SS 304	1	
9	324-009	SPRING	SS 302	1	
10	324-010	DIAPHRAGM	FAIRPRENE/TFE	1	(Y)
11	324-011	O-RING, BODY	NITRILE	2	(Y)
12	324-012	O-RING, POPPET	NITRILE	2	(Y)
13	324-013	CAPSCREW, BODY	SS 304	4	
14	324-032	CAPSCREW, CAP	SS 304	6	
18	324-018	CAPSCREW, OPERATOR	SS 304	1	
19	324-019	ROUNDHEAD PUSH BOLT	RHSN GR 5 ZN PL	1	
20	324-020	NUT, LEVER	GR 5 ZN PL	1	
28	324-028	PLUNGER	PVC	1	(Y)
35	324-035	DIAPHRAGM CAP	AL 6061-T6	1	
38	324-038	'M' LEVER	AL 6061-T6	1	
42	324-042	NUT, OPERATOR	SS 304	1	

NOTE: (Y) RECOMMENDED SPARE PARTS, PART NO. SPRK-A324-DM
FASTENERS AND MAINTENANCE TOOLS ARE ANSI/INCH SIZE
RECOMMENDED MAXIMUM 20 PSIG BACK PRESSURE AT EXHAUST PORT
FOR MANIFOLD MOUNTING, LOWER BODY (5) OMITTED

SPECIFICATIONS:
PORTS: 1/4 NPT
SERVICE: AIR, SWEET GAS, <5% H_2S SOUR GAS
TEMP. RATING: -50°C THRU 120°C
MASS: 3.7 LBm [1.7 kg]
MAWP: 1500 PSIG [10,300 kPa]
MAX. SIGNAL: 150 PSIG NOMINAL RATIO 12:1

UNLESS SPECIFIED OTHERWISE
ALL DIMENSIONS INCHES [mm]

UPDT LOGO
6 AS-1998-04-28 @ 6053-1-B
UPDT STDS
5 RS-1995-12-07@SALES REQ
UPDT BOM
4 JY-1992-12-18@SALES REQ
UPDT TITLEBLOCK
3 KN-1992-06-11@SALES REQ
REV BY-DATE+REF

TOLERANCES
XXX ±0.5 [±10]
XX ±0.2 [±5]
X ±0.1 [±2]

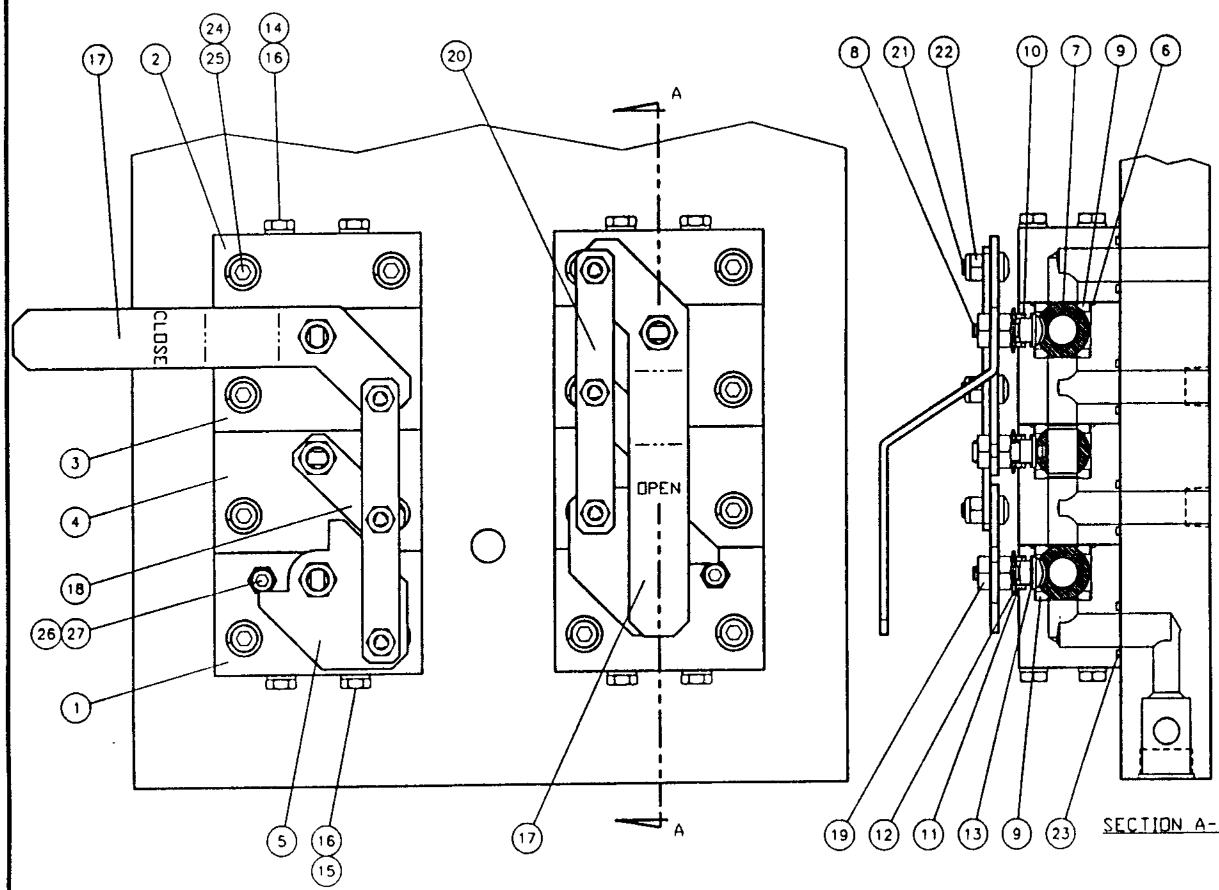
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BETTIS CANADA LTD.

MODEL A324-DM SWITCHING RELAY
(3-WAY, 2-POSITION, N.C.)
ASSEMBLY, DATA AND DIMENSIONS

C-0034--.DWG_VIEW_00
APR-28-98

WEIGHT	SEE ABOVE
SCALE	3:8
BY	TS
CHK	[illegible]
DATE	JAN-15-81
W.O.	04892-1-N
DWG. NO.	C-0034-00
REV	6-

DWG. NO. C-0034-00



ITEM	DESCRIPTION	MATERIAL	QTY	NOTE
1	END BODY	AL 6061-T6	2	
2	END CAP	AL 6061-T6	2	
3	DRILLED CENTER BODY	AL 6061-T6	2	
4	TAPPED CENTER BODY	AL 6061-T6	2	
5	VALVE MANIFOLD STOP	A366 ZN.PL	2	
6	O-RING, VALVE	NITRILE	6	(Y)
7	BALL	SS 302/../316	6	
8	STEM	17-4 PH H1150	6	
9	SEAT	DELRIN	12	(Y)
10	STEM PACKING	25% GFT	6	(Y)
11	PACKING FOLLOWER	SS 302/../316	6	
12	BELLEVILLE WASHER	SS 302	12	
13	THRUST WASHER	25% GFT	6	(Y)
14	CAPSCREW, VALVE	HXHC SS 304	8	
15	CAPSCREW, VALVE	HXHC SS 304	8	
16	LOCKWASHER	HLCK SS 304	16	
17	HANDLE, "CLOSE"/"OPEN"	A366 ZN.PL	1/1	(1)
18	LEVER	A366 ZN.PL	4	
19	JAM NUT, VALVE	HEXJ GR 5 ZN.PL	12	
20	CONNECTING ROD	A366 ZN.PL	2	
21	SCREW, CONNECTING ROD	SLRM SS 304	6	
22	LOCKNUT, CONNECTING ROD	HEXL NYLON/SS	6	
23	O-RING, MANIFOLD	NITRILE	8	(Y)
24	CAPSCREW, MANIFOLD	HXSC SS 304	16	
25	LOCKWASHER	HLCK SS 304	16	
26	CAPSCREW, STOP	HXSC SS 304	2	
27	NUT, STOP	HEXN SS 304	2	

NOTE:
-QTY ABOVE IS PER SET (LEFT AND RIGHT HAND)
-(1) LEFT HANDLE 'CLOSE' CW, RIGHT HANDLE 'OPEN' CCW
-(Y) RECOMMENDED SPARE PARTS, PART NO. SPRK-WBMC

UNLESS SPECIFIED OTHERWISE ALL DIMENSIONS INCHES (mm)

UPDT LOGO
△ AS-1998-04-28 @ 6053-1-B
ADD SPRK-WBMC TO NOTE
△ RS-1998-01-27 @ 6051-1-B
REV BY-DATE+REF

TOLERANCES
XXX ±0.5 (±10)
XX ±0.2 (±5)
X ±0.1 (±2)

BETTIS Actuators & Controls — BETTIS CANADA LTD.

WBMC SELECTOR VALVES, "OPEN" AND "CLOSE", ASSEMBLY

APO648--.DWG_VIEW_00 APR-28-98

WEIGHT 13.2 LB

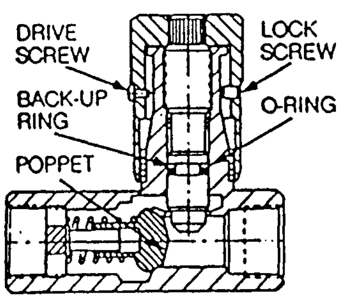
SCALE 1:2 | BY DY | CHK AA-1998-04-28 | DATE FEB-12-96

V.O. 09009-15R | DWG NO APB0648 | REV 2-

DWG NO. APB0648

Colorflow® Service Parts

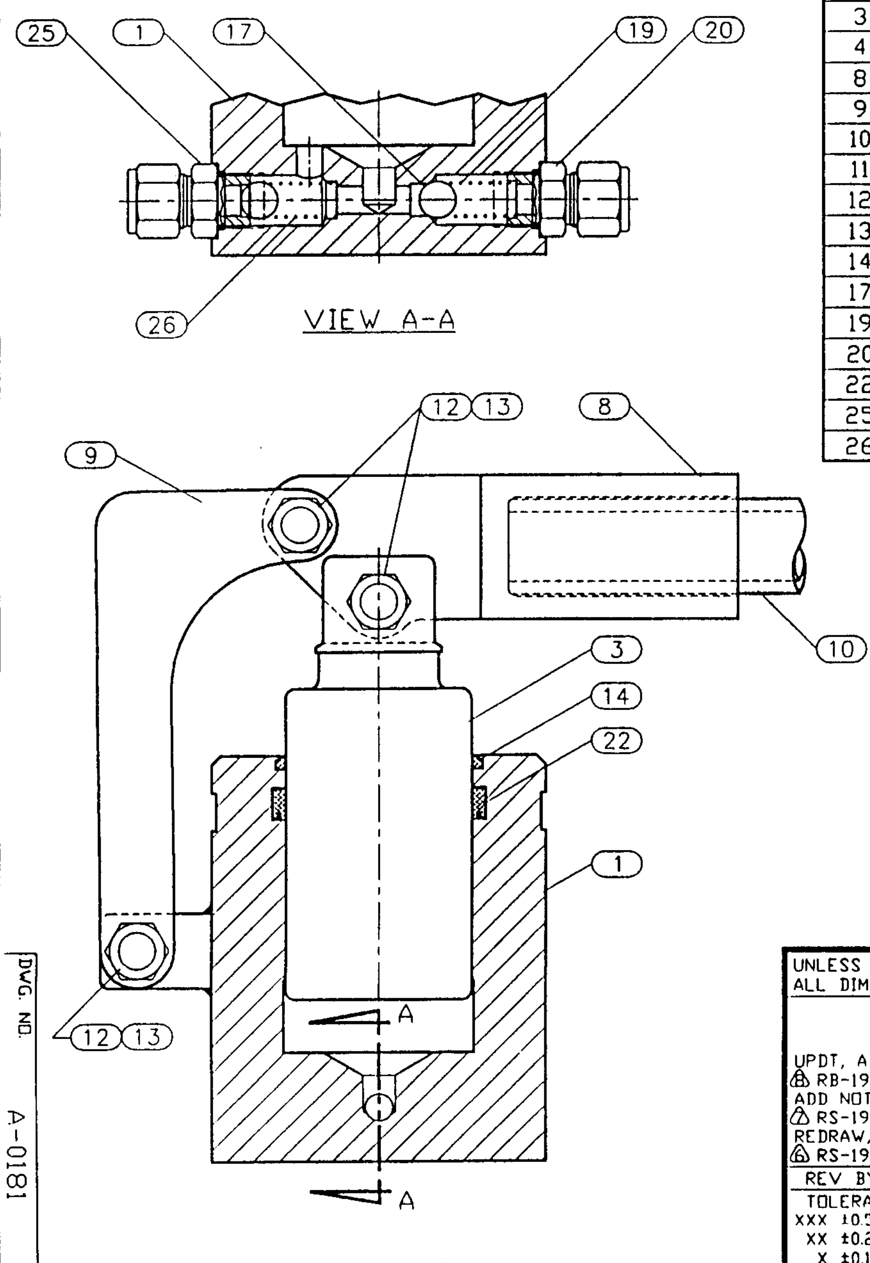
SERIES F



Flow Control Valves

SIZE	O-RING		BACK-UP RING	POPPET (STEEL)	POPPET (SOFT SEAL)		DRIVE SCREW	LOCK SCREW
	BUNA	VITON			BUNA	VITON		
F 200	5101N-7	5101V-7	NONE	013155-3	—	—	013300	001832
F 400 F 620	2006N-7	2006V-7	107X6	001490-3	001839N-7	001839V-7	001830	001832
F 600 F 820	2008N-7	2008V-7	107X8	004374-3	004917N-7	004917V-7	004677	004691
F 800 F 1020	2010N-7	2010V-7	107X10	007300-3	007596N-7	007596V-7	007523	007524
F 1200 F 1220	2011N-7	2011V-7	107X11	010353-3	N/A	N/A	010673	010678
F 1420	2012N-7	2012V-7	107X12	010353-3	N/A	N/A	010673	010678
F 1600 F 1620	2112N-7	2112V-7	107X112	025299-3	N/A	N/A	025543	025544
F 2000	2112N-7	2112V-7	107X112	022195-3	N/A	N/A	025543	025544
F 2020	2113N-7	2113V-7	107X113	022195-3	N/A	N/A	025543	025544
F 2400	2112N-7	2112V-7	107X112	026143-3	N/A	N/A	025543	025544
F 2420	2113N-7	2113V-7	107X113	026143-3	N/A	N/A	025543	025544
F 3200	2112N-7	2112V-7	107X112	030166-3	N/A	N/A	025543	025544
F 3220	2116N-7	2116V-7	107X116	030166-3	N/A	N/A	025543	025544

*Soft Seal Poppets not recommended for hydraulic service above 1000 PSI.



ITEM	DESCRIPTION	DWG./PART NO.	MATERIAL	QTY	NOTE
1	BODY	AP-0138	AISI C1020	1	
3	PISTON	AP-0139	AISI C1045 CH.PL	1	
4	BOOT	AP-0136	NITRILE	1	(H)
8	LEVER ASSEMBLY	AP-0073	AISI 1020	1	
9	LINK	AP-0129	CS	2	
10	HANDLE	AP-0128	CS	1	
11	HANDLE RING	AP-0076	CS	2	(H)
12	PIN	HXHC 1/2NC X 2	GR 5	3	
13	LOCKNUT	HEXN 1/2NC	GR 5	3	
14	WIPER	#959-25	MOLYTHANE	1	(Y)
17	BALL	1/2 DIA	STEEL CH.PL	2	
19	DISCHARGE SPRING	AP-0077	SS 302	1	
20	DISCHARGE ADAPTER	AP-0140	SS 316	1	
22	SEAL	#1870-2500-375	MOLYTHANE	1	(Y)
25	SUCTION ADARTER	AP-0130	SS 316	1	
26	SUCTION SPRING	AP-0141	SS 302	1	

NOTE:
1) (H) NOT SHOWN; (Y) RECOMMENDED SPARE PARTS, PART NO. SPRK-HP-X eg. HP-14, HP-9 OR HP-3
2) FASTENERS AND SERVICE TOOLS ARE ANSI/INCH SIZE
3) ITEM 17 AND 26 NOT USED IN CONJUNCTION WITH G/H PANEL AS ITEM 8 IN PANEL SERVES AS SUCTION CHECK VALVE

UNLESS SPECIFIED OTHERWISE
ALL DIMENSIONS INCHES [mm]

UPDT, ADD BOOT
RB-1998-04-01 @ 06053
ADD NOTE No. 3
RS-1998-01-26 @ 06051-1-B
REDRAW, UPDT STDS, HP WAS HV
RS-1996-11-27 @ SALES
REV BY-DATE+REF

TOLERANCES
XXX ±0.5 [±10]
XX ±0.2 [±5]
X ±0.1 [±2]

BETTIS Actuators & Controls
A Daniel Industries Company
BETTIS CANADA LTD.

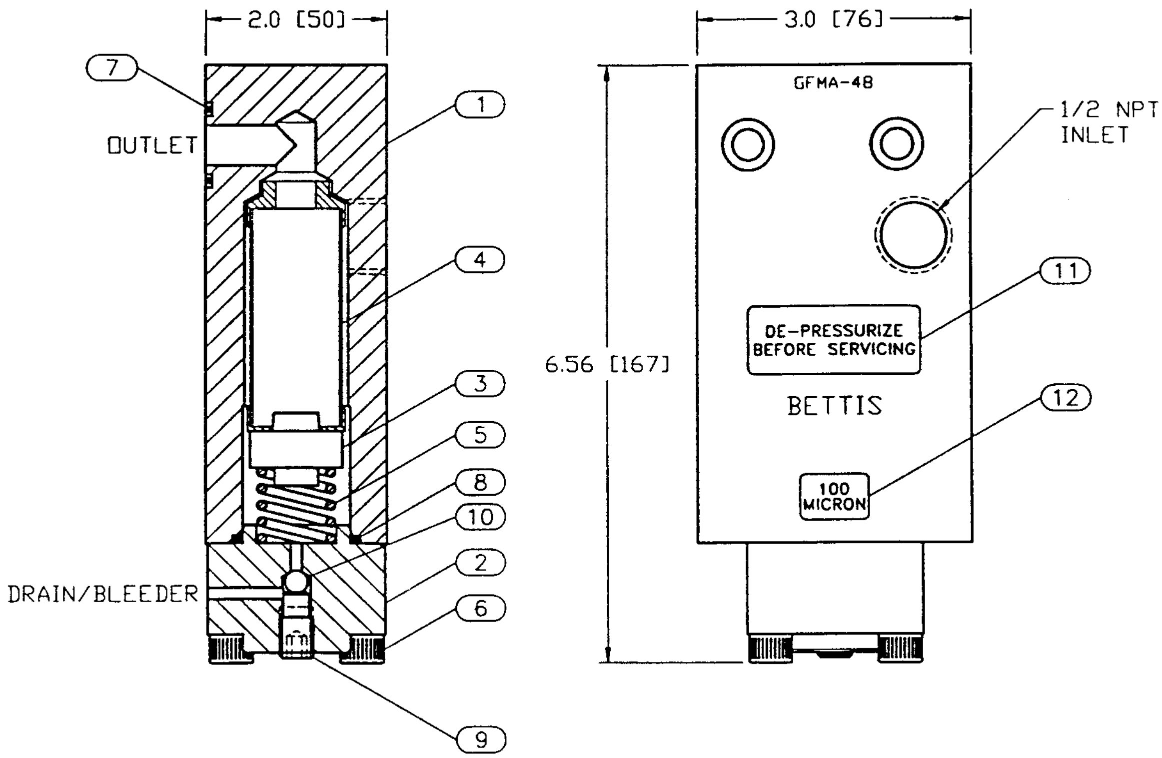
HANDPUMP SERIES HP

A-0181--.DWG_VIEW_00
APR-01-98

SCALE 2:5	BY RO	CHK AP-1998-04-01	DATE MAR-03-83
W.O. ---		DWG. NO. A-0181	REV 8-

ITEM	PART NO.	DESCRIPTION	MATERIAL	QTY	NOTE
1	907-001	BODY	AL 6061-T6	1	
2	907-002	CAP	AL 6061-T6	1	
3	907-003	BUTTON	AL 6061-T6	1	
4	907-024	FILTER, 75 MICRON	SS 303/../304	1	(Y)
5	907-005	SPRING	SS 302	1	
6	907-007	BOLT	SS 304	4	
7	907-009	O-RING, OUTLET	VITON	1	(Y)
8	907-010	O-RING, CAP	VITON	1	(Y)
9	907-014	BLEEDER PLUG	SS 304	1	
10	907-015	BLEEDER BALL	SS 440C	1	
11	907-006	DECAL (DE-PRESSURIZE...)	VINYL	1	
12	907-051	DECAL (100 MICRON)	VINYL	1	

NOTE: (Y) RECOMMENDED SPARE PARTS, PART NO. SPRK-GFMA
FASTENERS AND MAINTENANCE TOOLS ARE ANSI/INCH SIZE



UNLESS SPECIFIED OTHERWISE
ALL DIMENSIONS INCHES [mm]

UPDT LOGO
7 AS-1998-04-28 @ 6053-1-B
UPDT SS 303/../304 FILTER
6 RS-1998-01-29 @ 06051-1-B
REDRAW, +TOOLS, DECAL
5 RS-1995-11-30 @ SALES
REDRAW, +DIM'S, w/ BLEEDER
4 VL-1994-12-14 @ SALES
REV BY-DATE+REF

TOLERANCES
XXX ±0.5 [±10]
XX ±0.2 [±5]
X ±0.1 [±2]

BETTIS BETTIS CANADA LTD.
Actuators & Controls
A Daniel Industries Company

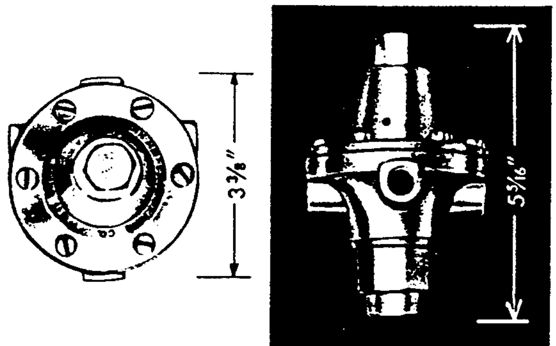
CUTAWAY ASSEMBLY AND DIMENSIONS
GFMA-48
GAS FILTER

A-0182--.DWG_VIEW_00 APR-28-98		WEIGHT 1.42 LB	
SCALE 1:2	BY EB	CHK	DATE JUN-10-91
W.O. ---		DWG. NO. A-0182	REV 7-

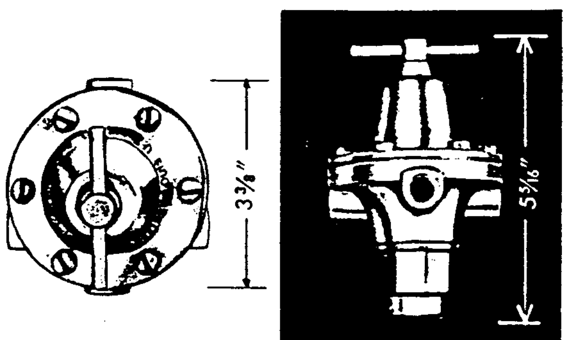
(i-0006--.wpd)

MECO INDUSTRIAL REGULATORS

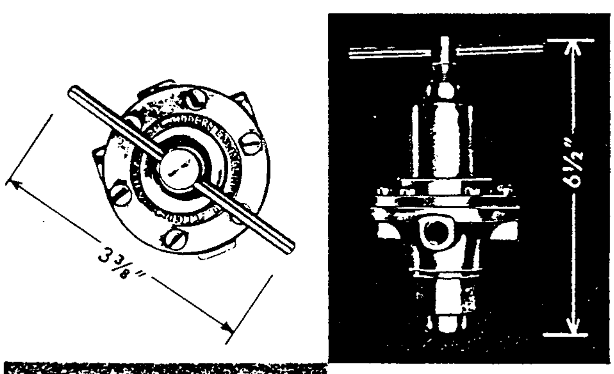
Type "P" HIGH PRESSURE REGULATORS
for gas pressures to 6000 psi



STYLE P-1DA/8465



STYLE P1-DC/8484



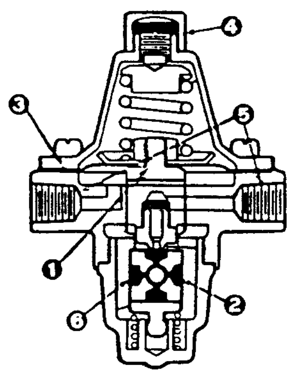
STYLE P1-DD/8373

With the advance of varied mechanical apparatus, operated by compressed air or other gases, industry needs dependable regulation to lower receiver pressures to working pressures for the operation of pneumatic feeds and controls.

Backed by more than half a century of research and experimentation, P Industrial Regulators are designed to fill numerous industrial compressed air or gas pressure control needs.

Regulation is accurate and pressure control is uniform under constant or interrupted gas flow. All P Industrial Regulators will reduce inlet pressures of 6000 PSI or less to outlet pressures of 5 to 500 PSI.

Our engineering department is at your service to help develop the appropriate regulator should you fail to find such shown.



SPECIAL FEATURES!

➊ **Dia-Blok construction** — features the diaphragm being positively connected to the regulator seat block by means of a yoke. Thus, any pressure on the diaphragm results in the diaphragm and seat moving the same distance at exactly the same time, thereby providing long seat life.

➋ **Multi-Seat Block**—features a square block containing four extruded non-combustible seats which can be easily revolved from one seat to another, whenever a seat needs to be changed in the regulator.

➌ **Stainless Steel Diaphragms**—feature minimized pressure fluctuation within the regulator by their extremely long life and ability to maintain constant elasticity. Thousands of diaphragms have been known to last 25 years or more, without replacing.

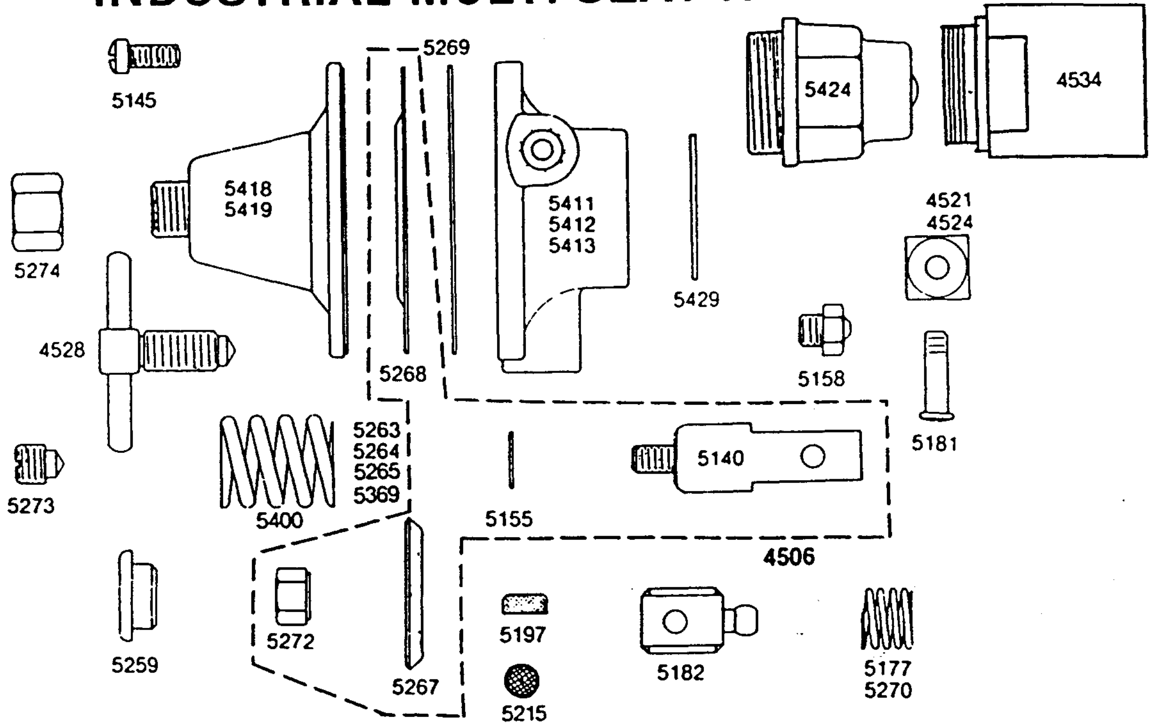
➍ **Tee-Handle or Slotted Adjusting Screws**—feature two available means of adjustment that can be had on all of the P Industrial Regulators, with the exception of Series 8370.

➎ **Inlets and Outlets**—feature the possibility of either right hand or left hand inlet or straight through and right hand, left hand, bottom or top outlet—or a combination of them.

➏ **Various Seating Materials**—feature a choice of either Nylon or Kel-F, depending on gas service used.

No special tools or skill are required to change seats in the P Industrial Regulators. A change of seats is an adjustment—not a repair job. Seat material, which varies with gases used, is shown in the specification table.

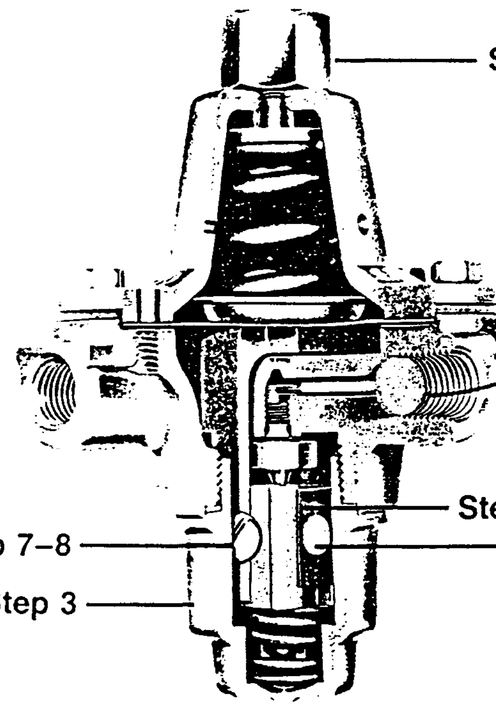
TYPE P-30, P-50, P-125, P-150, & P-225
INDUSTRIAL MULTI-SEAT REGULATOR

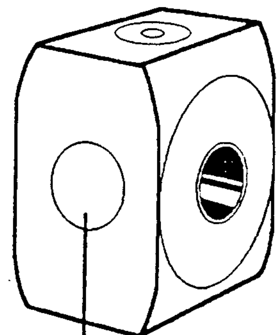


Stock No.	Description
4506	Diaphram-Yoke Assembly
4521	Seat Block with White Nylon Seats
4524	Seat Block with Kel-F Seats for CO_2
4528	Adjusting Screw Assembly
4534	ENVIRO-CAP, Water Heated Back Cap Assembly
5140	Yoke (Part of 4506)
5145	Bonnet Screw 6 required, Pkg. 12
5155	Yoke Gasket, Teflon, Pkg. 12 (Part of 4506)
5158	Nozzle with 5/64" Orifice, Pkg. 6
5177	Rear Spring, for over 500 PSI Inlet Pressure, Standard
5181	Yoke Clamping Screw, Pkg. 6
5182	Yoke Guide
5197	Filter Screen, pkg. 6
5215	Sintered Filter, pkg. 12, Standard
5259	Spring Button
5263	Compression Spring for 30 PSI Pressure (Red)
5264	Compression Spring for 125 PSI Pressure (Green)
5265	Compression Spring for 150 PSI pressure (Purple)
5267	Diaphragm Plate (Part of 4506)
5268	Stainless Steel Diaphragm (Part of 4506)
5269	Diaphragm Gasket, Pkg. 6
5272	Diaphragm Plate Nut (Part of 4506)
5273	Slot Type Adjusting Screw
5274	Protection Cap for Slot Adjusting Screw
5369	Compression Spring for 50 PSI pressure (Black)
5400	Compression Spring for 225 PSI pressure (Grey)
5411	Body, 1 inlet, 2 outlets P-1-DA
5412	Body, 1 inlet, 3 outlets P-1-DC
5413	Body, 2 inlets, 2 outlets P-1-DD
5418	Bonnet, for "T" Type Adjusting Screw
5419	Bonnet, for Slotted Type Adjusting Screw
5423	Allen Head Adj. Screw
5424	Back Cap
5429	Back Cap Gasket, Teflon, Pkg. 12

Instructions for Changing Seat Blocks in MECO Type "P" Industrial Regulators

(average time required: 12 to 15 minutes)





1. Remove Type P Industrial Regulator from system.

2. Turn adjusting screw (clock-wise) in, approximately half way.

3. Clamp backcap of Type P Regulator in jaws of a vise; firmly, **but not too tight!**

4. Obtain a short length of steel pipe, or steel rod threaded ¼" NPTM, and insert this into the inlet of the regulator to use as a lever.

5. Remove the regulator from the backcap (held in vise); turning the regulator counter-clockwise, by striking the steel pipe or rod with the heel of the hand.

6. Remove regulator from backcap, which is still clamped in the vise, using care not to lose the backcap spring, located in the bottom of the backcap.

7. Place regulator yoke and seat block assembly on a **flat, steady surface**, such as a work bench with the yoke clamping screw pointed up.

8. Holding the regulator bonnet in one hand; remove the yoke clamping screw with a standard screw driver; **counter-clockwise.**

9. Hold seat block between thumb and forefinger and **pull completely out** from the prongs of the regulator yoke.

10. Remove seat block from yoke guide and turn seat block until an unused **(undented)** seat surface is found.

11. Slip seat block back into the seat guide with the **unused seat surface facing regulator nozzle.**

12. Hold seat block with thumb and forefinger and insert into the prongs of the regulator yoke; lining up the hole in the yoke guide with the threaded hole in the yoke.

13. Grasp regulator in one hand; insert yoke clamping screw into yoke and yoke guide (enclosing seat block), and tighten yoke clamping screw with screw driver; clockwise.

14. Blowout interior of regulator with clean shop air.

15. Check backcap gasket for possible wear and replace with new gasket if required.

16. Remove backcap spring from backcap; blow out interior of backcap with clean shop air and replace spring.

17. Insert regulator into backcap, (held in vise), and turn clockwise, tightening regulator onto the backcap with the aid of the steel pipe or rod that was screwed into the regulator inlet.

18. Remove steel pipe or rod that was used as a lever and retain in tool box for future use.

19. Replace regulator into system, making sure all connections on inlet and outlet are tight.

20. Turn regulator adjusting screw counter-clockwise until no tension is found. Pressurize system with downstream valve closed.

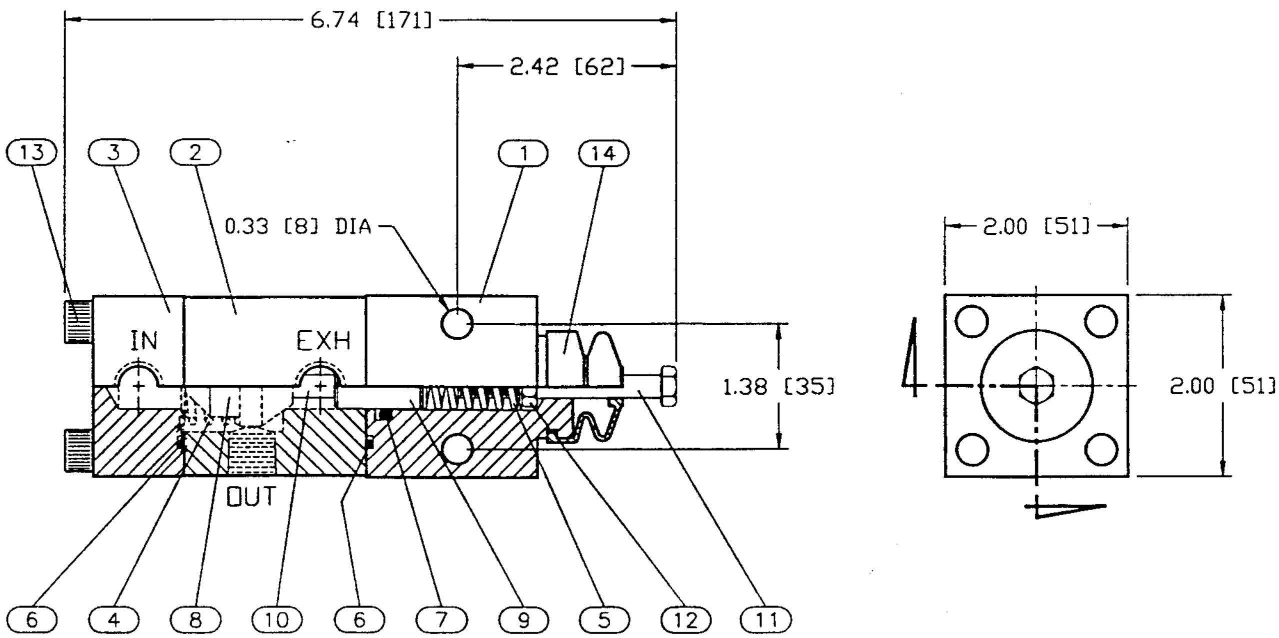
21. Turn regulator adjusting screw in (clock-wise) until 38 PSI is registered on the downstream side of the system; then back adjusting screw off; removing tension (counter-clockwise); this procedure making a good nozzle impression in the regulator seat, for correct operation.

22. Open downstream valve to bleed off gas trapped in regulator.

23. Regulator is now seated correctly and ready for use.

ITEM	PART NO.	DESCRIPTION	MATERIAL	QTY	NOTE
1	906-001	UPPER BODY	AL 6061-T6	1	
2	906-002	CENTER BODY	AL 6061-T6	1	
3	906-003	LOWER BODY	AL 6061-T6	1	
4	906-004	LOWER SPRING	SS 302	1	
5	906-005	UPPER SPRING	CR VAN	1	
6	906-006	O-RING - BODY	BUNA N	2	(Y)
7	906-007	O-RING - POPPET	BUNA N	1	(Y)
8	906-008	POPPET	PVC	1	(Y)
9	906-009	PLUNGER	PVC	1	(Y)
10	906-010	POPPET SPACER	ALLOY STEEL	1	
11	906-011	CAPSCREW - TRIGGER	GR. 5 PL	1	
12	906-012	NUT - TRIGGER	GR. 5 PL	1	
13	906-013	CAPSCREW - BODY	GR. 5 PL	4	
14	906-014	TRIGGER BOOT	NITRILE	1	

NOTE:
- (Y) SOFT PARTS REPAIR KIT PART NO. SPRK-ES-01



SPECIFICATIONS:

PORTS: 1/4 NPT
SERVICE: AIR, SWEET GAS, < 5% H2S SOUR GAS
TEMP. RATING: -50°C THRU 120°C
MASS: 2.0 LBm [0.9 kg]
MAX. WORKING PRESSURE: 150 PSIG
MAX. PRESSURE EXH. PORT: 30 PSIG
MAX. TRIGGER OPERATING FORCE: 40 LB @ 150 PSI

UNLESS SPECIFIED OTHERWISE
ALL DIMENSIONS INCHES [mm]

UPDT LOGO
4 AS-1998-04-27 @ 6053-1-B
UPDT STDS, ADD MAX TRIGGER OPERATING FORCE
3 VL-1996-04-01 @ 7482-1-B
UPDT BOM, IN WAS NO. OUT WAS COM
2 JY-1992-12-22 @ SALES
REV BY-DATE+REF

TOLERANCES
XXX ±0.5 [±10]
XX ±0.2 [±5]
X ±0.1 [±2]

BETTIS BETTIS CANADA LTD.
Actuators & Controls
A Daniel Industries Company

MODEL ES-01
(3-WAY CAM OPERATED)
ASSEMBLY AND SPECIFICATIONS

C-0082--.DWG
APR-27-98

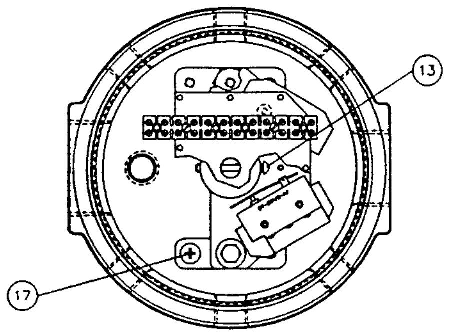
WEIGHT SEE ABOVE
SCALE 1:2 | BY EB | CHK [illegible] | DATE JUN-21-89
W.O. 07116-R-E | DWG. NO. C-0082 | REV 4-

(i-0006--.wpd)

DWG NO. IB0048-08

ITEM	DESCRIPTION	MATERIAL	QTY	NOTE
1	HOUSING	TENZALLOY	1	
2	COVER	TENZALLOY	1	
5	SHAFT	SS 316	1	
10	CAM	AL 6061-T6	8	
12	SETSCREW, CAM	SS 304	8	
13	TRIGGER SCREW	NYLON	8	
14	PRESSURE LAMINATE	PHENOL FABRIC	10	
15	TERMINAL BLOCK	MK3/12 MELAMINE	2	
16	MICROSWITCH	DT-2RV3-A7	8	
17	GROUND SCREW	SS 304	1	
18	O-RING, SHAFT	NITRILE	1	
19	O-RING, HOUSING	NITRILE	1	
28	HEATER	CERAMIC	1	(O)
31	DRAIN	SS 304	1	

NOTE:
- (O) DENOTES SUPPLIED AS OPTION
- FASTENERS AND SERVICE TOOLS ARE ANSI/INCH SIZE



SWITCHPAK INSTALLATION AND SERVICE

SWITCHPAK ROTARY POSITION INDICATING SWITCHES, MODELS SW28XX, ARE SUPPLIED WITH 8 SWITCHES, ADJUSTABLE THROUGH 360° OF SHAFT ROTATION. THE DRAWING ILLUSTRATES A TYPICAL 8 SWITCH UNIT AND MOUNTING ARRANGEMENT. THE ENCLOSURE IS WATERTIGHT AND SUITABLE FOR INSTALLATION IN CLASS 1 DIV. 1 GROUP C & D HAZARDOUS LOCATIONS.

INSTALLATION

1. REMOVE COVER (2).
2. ATTACH HOUSING (1) TO STATIONARY BRACKET, WITH CAM SHAFT AND ROTARY STEM ENGAGED.
3. BEFORE TIGHTENING MOUNTING BOLTS, ALIGN CAM SHAFT CONCENTRIC TO STEM AND POSITION CAMS WITH SETSCREWS (12) AS SHOWN. ENSURE THAT BOTH STEM AND SHAFT CAN BE ROTATED WITHOUT BINDING BEFORE TIGHTENING SETSCREWS.
4. IN HAZARDOUS LOCATIONS, INSTALL SEALING FITTING(S) IN ACCORDANCE WITH LOCAL REGULATIONS AND NATIONAL CODE.
5. SECURE GROUND WIRE(S) TO GROUND SCREW (17). ENSURE THAT ALL WIRES ARE FREE OF STRAIN AND LOCATED TO CLEAR COVER.

SETPOINT ADJUSTMENT

SETPOINTS ARE FACTORY SET PER WIRING DIAGRAM, IF APPLICABLE. TO ADJUST, LOOSEN SETSCREW (12), ROTATE CAM TO POSITION DESIRED AND RE-TIGHTEN SETSCREW.

SENSITIVITY ADJUSTMENT

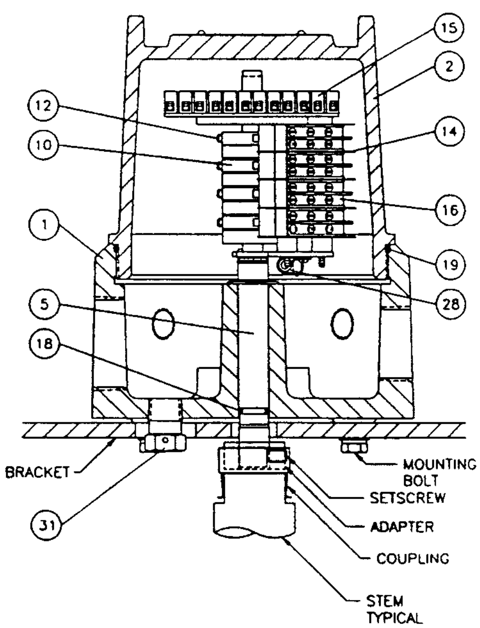
SENSITIVITY IS NORMALLY FACTORY SET. TO ADJUST, TURN TRIGGER SCREW (13) OUT TO ADVANCE AND LENGTHEN SIGNAL, TURN IN TO SHORTEN AND DELAY. USE 0.001" FEELER (GAP) GAUGE TO ENSURE NO SWITCH LEVER CONTACT WITH SWITCH BODY.

MICROSWITCH REPLACEMENT

1. DISCONNECT SUPPLY CIRCUIT(S) BEFORE REMOVING COVER.
2. ROTATE CAM SHAFT TO INTERMEDIATE (MICROSWITCHES UNACTUATED) POSITION.
3. DEMOUNT TERMINAL STRIP(S) IF PRESENT.
4. NOTE MICROSWITCH ARRANGEMENT (TWO STACKS, STAGGERED WITH SPACERS ABOVE ONE, BELOW THE OTHER) FOR RE-ASSEMBLY.
5. REMOVE MICROSWITCH MOUNTING SCREWS.
6. REPLACE DEFECTIVE MICROSWITCH AND CHECK THAT LAMINATE SEPARATES EACH SWITCH.
7. REPLACE MICROSWITCH MOUNTING SCREWS

CAUTION

ENSURE COVER JOINT THREADS AND O-RING ARE FREE OF DEBRIS AND LUBRICATED BEFORE REPLACING COVER. IN HAZARDOUS LOCATIONS, KEEP COVER TIGHTLY CLOSED WHILE CIRCUITS ARE ALIVE.



UPDT LOGO
△ AS-1998-04-28 @ 6053-1-B

REV BY-DATE+REF

MATERIAL/FINISH

UNLESS SPECIFIED OTHERWISE
ALL DIMENSIONS INCHES [mm]

TOLERANCES

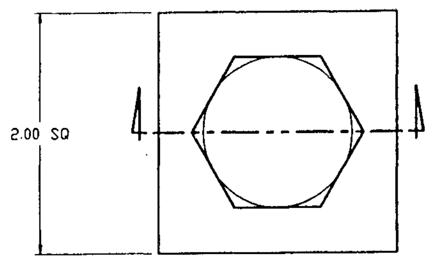
DECIMALS	RMS	FRACTIONS
.X ±0.05	500	XX-X/X ±1/16
.XX ±0.02	250	X-X/X ±1/32
.XXX ±0.005	125	X/X ±1/64
T.I.R. ±0.010	THD ±1 TURN	∠ ±1°

BREAK SHARP EDGES
CHAMFER FIRST THREAD
REMOVE ALL BURRS

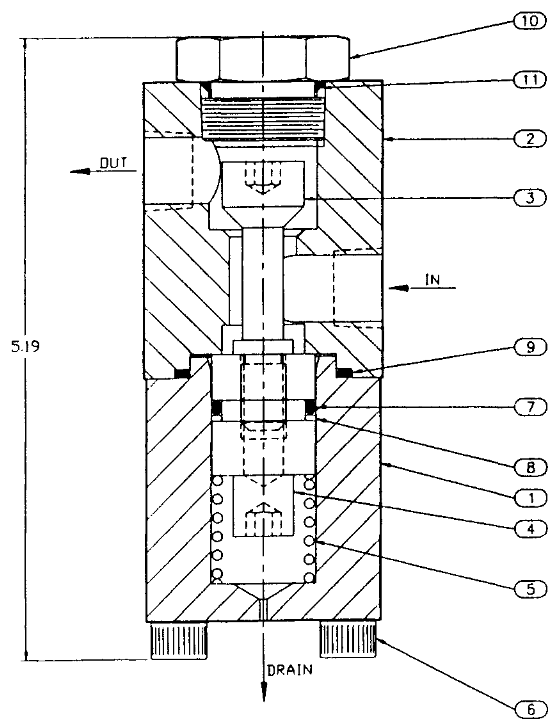
BETTIS Actuators & Controls — BETTIS CANADA LTD.

SWITCHPAK SW28XX
INSTALLATION AND ADJUSTMENT

I-0048--.DWG_VIEW_08 APR-28-98		WEIGHT	
SCALE 1:3	BY VL	CHK	DATE DEC-04-95
W.O. 07482-1-B	DWG NO. IB0048-08		REV 1-



TOP VIEW



SIDE VIEW CUTAWAY

ITEM	PART NO.	DESCRIPTION	MATERIAL	QTY	NOTE
1	905-421	LOWER BODY	AL 6061-T6	1	
2	905-422	UPPER BODY	AL 6061-T6	1	
3	905-423	POPPET	SS 316	1	
4	905-424	PISTON	AL 6061-T6	1	
5	905-408	SPRING	SS 304	1	
6	905-410	CAPSCREW, HEX SOCKET	SS 304	4	
7	905-427	O-RING, PISTON	NITRILE	1	(Y)
8	905-428	BACK-UP RING, PISTON	NITRILE	1	(Y)
9	905-429	O-RING, BODY	NITRILE	1	(Y)
10	905-430	HEX PLUG	AL 7075-T651	1	
11	905-432	O-RING, PLUG	NITRILE	1	(Y)

NOTE:
- (Y) RECOMMENDED SPARE PARTS REPAIR KIT PART NO. SPRK-SV06T2
- FASTENERS AND MAINTENANCE TOOLS ARE ANSI/INCH SIZE

INSTALLATION: (GAS HYDRAULIC UNITS)
- INSTALL BETWEEN CONTROL PANEL (IN) AND HANDPUMP SUCATION PORT (OUT).
- ENSURE DRAIN HOLE IS FACING DOWN.
- TIGHTEN HANDPUMP LINKAGE BOLTS TO 10 FT-LB FOR OPTIMUM PERFORMANCE.
- OPERATIONAL TEST: RAM RISE ≤ 1/4" @ 750 PSI SUPPLY.

UPDT LOGO
AS-1998-04-28 @ 6053-1-B
UPDT STDS, UPDT TABLE, ADD MISSING LABEL (ITEM 1)
VL-1995-12-01@7482-1-B
REDRAWN ON CAD, UPGRADE HEX HD PLUG
DY-1993-12-03@9009-R&D
REV BY-DATE+REF

MATERIAL/FINISH

UNLESS SPECIFIED OTHERWISE
ALL DIMENSIONS INCHES (mm)

TOLERANCES

DECIMALS		RMS	FRACTIONS	
X	±0.05	500	XX-X/X	±1/16
.XX	±0.02	250	X-X/X	±1/32
.XXX	±0.005	125	X/X	±1/64

T.I.R. ±0.010 THD ±1 TURN ∠ ±1°

BREAK SHARP EDGES
CHAMFER FIRST THREAD
REMOVE ALL BURRS

BETTIS Actuators & Controls — BETTIS CANADA LTD.

HANDPUMP SAFETY VALVE
SV-06 TYPE 2, ASSEMBLY

AP0815--DVG APR-28-98		WEIGHT	1.85 LB
SCALE 1:1	BY AG	CHK AA1996-04-24	DATE FEB-25-91
V.O. 09009-R&D	DWG. NO. APB0815		REV 6-

DWG NO. APB0815

BETTIS
Actuators & Controls
A Daniel Industries Company

Bettis Canada Ltd.
4112 91A Street
Edmonton, Alberta, Canada T6E 5V2
Tel: (403) 450-3600
Fax: (403) 450-1400

FIELD SERVICE REQUEST

To assist in providing service/assistance with your equipment the following information is requested:

A) CONTACT/RESPONSIBLE

NAME ______________________ COMPANY ______________________________________

POSITION __________________ SITE/PROJECT IDENTIFICATION ____________________

____

PHONE ______________ FAX __________________ PAGER _______________________

B) VALVE OPERATOR: ROTARY ☐ LINEAR/GATE ☐

MODEL ______________________ SERIAL NUMBER ________________________________

APPLICATION:
- ☐ MAINLINE BLOCK/LINEBREAK ESD
- ☐ MAINLINE VALVE STATION BYPASS
- ☐ UNIT SUCTION/DISCHARGE BLOCK
- ☐ METER STATION SHUT IN/H_2S SHUT IN
- ☐ PIG LAUNCHER/RECEIVER
- ☐ ______________________________

C) PROBLEM IDENTIFIED DURING:

☐ INSTALLATION ☐ COMMISSIONING ☐ OPERATION ☐ MAINTENANCE

D) PROBLEM IDENTIFIED AS: ____

(If operator/valve travel is open/closed fully or partially, How far?) __________________

____

____

____

(I-0100--.wpd/1 orig:db/mc-1993-08-09 rev 2:aa/mc1998-04-29 app M1998-04-29 dist:(EF)O;(SD,SL)P)

continued . . .

. . . continued

E) CHECK LIST FOR OFTEN-OVERLOOKED CAUSES

- ☐ TANK FLUID LEVELS ARE CORRECT FOR OPERATION
- ☐ POWER GAS OF SUFFICIENT PRESSURE AND FLOW IS PRESENT
- ☐ ESD/LINEBREAK SYSTEM IS RESET
- ☐ OPERATOR TRAVELS FULLY AND SMOOTHLY
  - ☐ SPEED CONTROLS ARE MORE THAN 25% OPEN
  - ☐ CORRECTLY MOUNTED ON VALVE, ie. VALVE OPEN/OPERATOR OPEN/STOPS SET
  - ☐ EXHAUSTS NOT RESTRICTED OR VENTED TO HEADER SYSTEM w/ BACK-PRESSURE
  - ☐ ALL RELAYS AND SOLENOIDS ARE SWITCHING
  - ☐ CONFIRM SIGNALS ARE BEING APPLIED AND REMOVED AS REQUIRED

F) IDENTIFY COMPONENT(S) THAT MAY CAUSE THE PROBLEM

LIST ANY ADJUSTMENTS THAT WERE MADE BY OTHERS ______________________________

____

____

____

____

G) CONDITIONS UNDER WHICH PROBLEM OCCURS

FLOWLINE	OPERATOR GAS SUPPLY
PIPELINE PRESSURE ____ psi[kPa]	FROM PIPELINE ____ psi[kPa]
DIFFERENTIAL ACROSS VALVE ____ psi[kPa]	FROM FUEL GAS LINE ____ psi[kPa]
PIPELINE RATE OF DROP ____ psi[kPa]/minute	

OTHER/WEATHER ____

H) REQUIREMENTS

____

____

____

(I-0100--.wpd/2 orig:db/mc-1993-08-09 rev 2:aa/mc1998-04-29 app M-1998-04-29 dist:(EF)O;(SD,SL)P)

XIX MAINTENANCE LOG

DATE	TEMP, PRESSURES, POINTS CHECKED OR MAINTENANCE DONE	BY

XX ROTARY GAS / HYDRAULIC NOTES